BACK IN THE BUSH;
SUSTAINABILITY, POSTMODERNISM AND INDIGENOUS FORESTS IN NEW ZEALAND

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The concept of **sustainability** has gained international attention in recent years as a potential universal solution to the worlds economic, social and environmental problems. The concept was at the centre of discussions at the United Nations Conference on Environment and Development (1992) at Rio de Janeiro. It has continued to be a focus of international, national and local conferences and initiatives.

In 1987 Edward Barbier published a paper entitled *The Concept of Sustainable Economic Development*. His paper outlined a model which attempted to overcome problems of previous definitions of sustainability. In this thesis Barbier's model of sustainability is expanded and reconceptualised in order to gain a greater understanding of the concept as well as increase its potential for use as a resource management tool. The theory of **Postmodernism**, particularly its critique of science, is introduced for a deeper understanding of the problems surrounding sustainability and assist in providing direction from a weak sustainability paradigm to a strong sustainability paradigm.

The reconceptualised model is used as an analytical framework to examine a case study involving an **indigenous forest** and its management in light of the recent introduction of the Forest Amendment Act 1993. This act requires indigenous forests to be managed on a sustainable basis. The model is also used to gain an insight into where we have come from and where we may be in terms of 'achieving' sustainability within indigenous forests in New Zealand.

Keywords. Sustainability, Postmodernism, Indigenous Forests.

Table of Contents

Table of Figures

1.0 Introduction

On the 1st of July 1993 the Forest Amendment Act came into being. It joined the recent list of New Zealand resource management legislation with a primary focus on ***sustainability***. With the passing of this Act owners of private indigenous forests are now legally obliged to manage their forests in a sustainable way[1]. While this legislation was generally hailed as a turning point in indigenous forest policy many, particularly forest owners, have been left confused to exactly what "sustainability" is and how it may be applied to their forests.

This thesis examines the concept of sustainability and the various interpretations of what it "is" or may be, particularly in relation to indigenous forests and forestry in New Zealand. Sustainability was chosen as a concept in need of critique, not only because it is now a requirement of the Forest Amendment Act 1993, but also because it is increasingly seen as the philosophical basis behind the discipline of resource management.

In a paper in 1987 Edward Barbier discussed a concept he termed *sustainable economic development*[2]. Rather than present yet another definition of the concept he interpreted sustainability through a model. His model of sustainable economic development has proved to be a useful conceptual framework from which to analyse the concept of sustainability. His model gained international acceptance at the Earth Summit in Rio de Janeiro in 1992 and since this time has been

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[1] The purpose of the Forest Amendment Act 1993 is "*to promote the sustainable management of indigenous forest land*". Sustainable management under the Forest Amendment Act is defined as "*the management of an area of indigenous forest land in a way that maintains the ability of the forest growing on the land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values*". The Amendment does not apply to forest lands managed by Timberlands Westcoast or lands reserved under the South Island Landless Natives Act 1906.

[2] The term Barbier used to defined the concept reflected his own standpoint as an economist. Throughout this thesis the term "sustainability" will generally be used in favour of sustainable development, sustainable management or any other similar term. Sustainability is more of a general term for the concept and appears to be the least value laden of the variations on the concept.

widely applied[3].

Edward Barbier's model of sustainability is described in the thesis and its usefulness is critiqued. Using his model as a basis a reconceptualised model is further developed. Through this process the many different roots and understandings of sustainability and their contradictions are exposed. This clarifies the concept of sustainability and then builds an analytical framework from which resource management issues may be analysed in terms of their 'sustainability'.

The reconceptualised model is tested as an analytical framework at the micro level using a case study of indigenous forest management in New Zealand today. It is used to determine whether the forest owner is interpreting and practising sustainability from a narrow or holistic standpoint (or a weakly or strongly sustainable position). The model is then later used in a more general fashion at a macro level to help examine the broader aspects of the indigenous forest industry, in particular legislation, policy and research. This is carried out in order to determine how the present construction of sustainability may help or hinder the present and future sustainability of New Zealand's indigenous forests.

In 1987, J.H Wikstrom of the USDA Forest Service described a new, or *Postmodern*[4], way of thinking about forestry [Wikstrom, 1987]. While theories of Postmodernism had been applied to disciplines from architecture to zoology he was the first to write about it in terms of forestry. Postmodernism and its critiques of science challenge the conventional wisdoms (or Modernist[5] view) about the

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[3] For example the model was used at the New Zealand Sustainable Land Management Conference, April 12-14, 1994, Lincoln University and has appeared in the Ministry for the Environment's 1993 publication *Securing the Future; a guide to agenda 21.*

[4] The terms *Modern* and *Postmodern* begin with capital letters to distinguish them from words such as contemporary.

[5] "*Modernism is the view that ideas grounded in (essentially) Western philosophy and science can serve as the basis of social criticism*" [Redclift in Redclift and Sage, 1994, p19]. Postmodernism presents a challenge to this view.

creation of knowledge. Science was early on seen by the author as a legitimate window for seeking an understanding the concept of sustainability. However, it became increasingly apparent that while science is useful for understanding some areas of the concept of sustainability it is also limited in its understanding. Science is only concerned with 'truths'. Within science beliefs are not seen as a legitimate form of knowledge. The concept of sustainability, however, was found to be made up a number up of beliefs and values. Such revelations, therefore, question science's ability to fully understand sustainability. Further, when science was deconstructed using the theory of Postmodernism it was found that science itself is based on a number of implicit beliefs. This then not only questions science's legitimacy as a superior form of understanding but 'in fact' some argue that the belief system science is based on thwarts an adequate understanding of sustainability. Through such a Postmodern lens, it is believed that one is better able to challenge the conventional wisdom and offer unconventional "solutions" of which sustainability is undoubtably one.

1.1 Statement of the Problem

In the course of this research it was found that the concept of *sustainability* means many different things to many different people. The concept is constructed from a diverse range of rationalities based a variety of world views.

While this is not a problem in itself (it is argued this diversity is an inherent and necessary attribute of sustainability), it has become apparent that some world views are seen by science as 'more' valid than others, if they are seen at all.

Further, it is argued that generally only a narrow range of rationalities ultimately find their way into policy, legislation and research efforts even those that are purportedly concerned with sustainability. Under such a situation only weakly sustainable outcomes are possible.

The problem is that while the concept of sustainability is made up of a diverse set of rationalities often when sustainability policies and practices are constructed only a narrow set of rationalities and values are considered by conventional wisdom to be legitimate. Paradoxically the sustainable 'solution' becomes an antithesis of sustainability.

1.2 Purpose

The overall purpose of this research thesis is explore the concept of sustainability and how it is being applied to indigenous forestry in New Zealand. This is carried out through the development and use of a conceptual framework for analysis. Through this process, I intend to shed light on the many dimensions and complexity of sustainability and be able to present a greater understanding of the concept and its contradictions; particularly to forest owners, the forest industry, resource managers, environmentalists and policy makers.

1.3 Objectives

To explore the question *What is sustainability?* with particular reference to indigenous forest land management[6] and forestry in New Zealand.

To critique the economic, ecological and social dimensions of the concept of sustainability in an attempt to find the essence of each and expose the contradictions between them.

To challenge conventional wisdoms and engage in different ways of thinking in the belief by doing so may result in different answers and ultimately a wider if not a

[6] Forest land management is used here to explicitly include the management, and 'non-management' of all 'products' (both physical and intrinsic) which are derived from the forest.

deeper understanding of what is being studied.

To look at a problem using methodologies and methods appropriate to the problem. Appropriate in this context means to use methodologies and methods which themselves are a reflection of what one is studying.

To consciously tie the theory and philosophy of sustainability to the practical dimension of indigenous forest management through the use of case studies, observation and experience and to write in a language which can be understood by those people whose lives this thesis actually seeks to improve.

To help empower forest owners with a philosophical, theoretical and practical base from which they can interpret and apply the concept of sustainability to their forests.

1.4 The Method

The method used to carry out my research was often not particularly planned being more intuitive and reflexive in nature than predesigned. This allowed me the privilege of becoming sidetracked at times before refocussing myself. In qualitative research "*the method needs to evolve out of the research question and be determined by it*" [Rudestam and Newton, 1992, p21]. A predesigned method which is rigidly adhered to may hinder the research focusing the researcher on the method rather than on answering the question [Rudestam and Newton, 1992]. Consequently my method only fully became apparent in hindsight.

My initial research was carried out through a literature review using the university library, interloan services and cdrom databases. Interviews with various people within government departments, particularly the Ministry of Forestry, as well as academics, forest owners and others were also carried out. This was not only an information gathering exercise but also helped me formulate my thesis

topic and set the bounds of it. The process continued as more detailed research was required to be carried out in specific areas.

Later my thesis grew to encompass field research initially using three main case studies of indigenous forests being managed for the production of timber and other forest products. Each of the forests chosen represented a range of sizes in terms of area, a range of different species contained within them, a range of market and organisational constraints which they operated within and a range of approaches taken in the management of their forests for a variety of values and products. Consequently insights into a range of philosophies and practices was gained. This was further enhanced by visits to two Timberlands West Coast forests, two forests reserved under the South Island Landless Natives Act, 1906 as well as another private forest.

While I had initially intended to include three case studies in this thesis I finally decided against it despite having collected the information I needed. This move was taken primarily because this thesis is not a comparative study and I found myself making value judgements about the different management systems which had been developed by the various forest owners. This I found unethical. Further the purpose of the case studies were to illustrate the use an analytical model I had developed. It was felt that it was sufficient to demonstrate once and unnecessary to demonstrate it three times. The last reason was that the shear volume of information which I had collected was beyond the bounds of what is generally required of a Masters thesis. The choice was to either analyse three superficially or one in depth. I chose the latter.

A social research method called participant observation [Friedrichs and LÜdtke, 1975; Jorgensen, 1989] was used to gather information from the forest owners. Participant observation can be defined as "*a field strategy, that simultaneously combines document analysis, respondent and informant interviewing, direct participation and observation, and introspection*" [Friedrichs and Lüdtke, 1975, p84]. Using this method I worked with and interviewed forest owners (and others

working in the forests) over a number of days or weeks at a time. The interviews involved participating in and helping forest owners with their work asking questions and gaining knowledge. I chose this method because I felt participant observation was appropriate to my own inquiry needs.

The participant observation method was chosen partly through an ethical belief that if knowledge is given it should be "paid" or reciprocated for; the payment in this case being labour for knowledge [after Robson, 1993]. Although I felt that the physical work I was doing was insignificant in comparison to the knowledge that I was gaining I felt that by giving something in return, no matter how small, I was at least acknowledging the worth of their knowledge.

The method was also selected on the recommendation of Friedrichs and LÜdtke [1975] in the belief that the information gained would probably be of a greater accuracy than a "behind the desk" interview. Interviewing in a formal setting and using a structured set of questions over a short period of time would probably not have enabled me to gather the knowledge that I have. Participant observation in the 'natural setting' helps to avoid problems of other interview techniques such as the interviewed subject not understanding questions, the subject supplying incomplete information because of their, perhaps false, perception of the interviewers research agenda and the inflexibility of structured interviews to reflect on knowledge gained and formulate new questions which may be more relevant to the problem [Friedrichs and LÜdtke, 1975; Jorgensen, 1989].

The question of *who I questioned* was also of significance. Initially I made contact with the male partner. However, I was aware of the importance played by the woman partner in the forest and her values and influence. I was also aware of the other workers in the forest and the part that they played and also 'interviewed' them. In this way I attempted to be inclusive and, therefore, gain a broader view of what was happening in terms of the human - forest relationship in the forest.

Another aspect of the 'design' of my method was to conscientiously tie the

philosophy and theory to the practice of real situations. The use of case studies and participant observation helped me achieve this.

An objective in the design of the method, related to the fore mentioned goal, is a personal desire to have my thesis read by indigenous forest owners and those who make decisions which affect these forest owners rather than gather dust on the shelves of academia. In order to make it accessible I have attempted to write in a style which reflects the audience for whom it is written. I have chosen language carefully and have attempted to use it in an empowering and enabling way. An expression of this is that the use of jargon is fully explained in the text or avoided all together. This has sometimes had to be balanced against scholastic requirements to the detriment of my objective.

1.5 Structure

In **Chapter 2** of this thesis the present state of the environment and the detrimental effects of economic growth and "progress" on the planet and its peoples are briefly outlined. The concept of sustainability is introduced as the remedy which the world has recently focused on for solving the problems of our degraded social and natural environment. The concept is problematic, however, with a number of fundamental contradictions. It is continually being redefined and debased and taking on meanings which are often similar to "unsustainable" Modernist practices. It is proposed that these problems can (at least in part) be traced to the number of different and disparate historical roots of the concept. It is suggested that the way forward is not through the futile practice of trying to find the perfect definition of sustainability. Others have realised the shortcomings of a definition of sustainability and one, Edward Barbier, instead preferred to construct sustainability in terms of a model. Barbier's model of sustainability first appeared in an essay in the publication *Environmental Conservation* [Barbier, 1987]. In short, the model presents the idea that sustainability is "achieved" when the three dimensions, those of social, ecological and economic, are integrated. The

model is reviewed and semantic changes are suggested.

Chapter 3 is entitled *A Reconceptualised Model of Sustainability*. While Barbier's model of sustainability is seen as a popular alternative to other, often ambiguous, definitions of the concept it is argued that the model is analytically weak. In this chapter his model is used as a basis and built upon in a 'reconceptualisation' of the original in an attempt to give a derived model greater analytical rigor. Charles Kidd's six roots of sustainability are introduced into the reconceptualised model. These are 1 The no-growth slow-growth root, 2 the resource - environmental root, 3 the ecology - conservation root, 4 the critique of technology root, 5 the ecodevelopment root and 6 the biosphere root. Each of these roots of sustainability has gone through various changes in thinking in the last one hundred years generally in a direction from 'weak sustainability' to 'strong sustainability' though for the most part the 'solutions' which have been favoured are considered to be 'weakly sustainable'.

In **Chapter 4** the theory of Postmodernism is introduced and its characteristics are discussed. The relevance of Modernism to 'weak sustainability' and Postmodernism to 'strong sustainability' is explored particularly in the context of the reconceptualised model. A critique of neoclassical (or Modernist) science and its construction of Nature[7], knowledge and reality is carried out. The conclusion is reached that the way that Modernist science constructs the world is fundamentally at odds with strong 'sustainability'. It is difficult for science in its present form to reconcile itself with holistic concepts such as this. A critique of the discipline of forestry is subsequently carried out, supported in the main by the work of Vandana Shiva and Chris Maser. The conclusion is reached that what is required to 'achieve' sustainability is a paradigm shift from the Modern 'scientific' construction of the world and Nature to a Postmodern construction based on a wider meaning of science (and forestry).

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[7] Nature begins with a capital letter in this thesis for the same reason that God is usually given a capital in texts, because of the author's respect and reverence for it.

In **Chapter 5** the reconceptualised model of sustainability is used to analyse a case study of indigenous forest management in New Zealand. The rationalities, relationships of the forest manager and others who work and live in the forest to their forest and management practices within the forest are explored. Comparisons with conventional (or Modernist) forestry practices are made particularly in relation to the attitudes and treatment of Nature and forests on neighbouring properties. Conclusions are made on whether or not these people appear to be "achieving" sustainability and the suitability of the reconceptualised model to determine this.

Chapter 6 considers whether the sustainability rationalities which have emerged throughout this thesis are being reflected in indigenous forest policy, legislative and research initiatives today. An historical overview of the indigenous forest industry is carried out and traces a number myths that have been created about New Zealand's indigenous forests and perpetuated through time. It is argued that these myths are hidden in indigenous forest policy, legislation and research and serve to hinder sustainability in indigenous production forests. A number of recommendations are made for improvement within these areas including the uncovering of these myths.

Chapter 7 contains conclusions.

The thesis finishes with an **epilogue**. This is a personal account of my personal journey in the construction of this thesis; the problems, dilemmas and progression made.

"*We need the humility to acknowledge sincerely that none of us is, or will ever be, omniscient. It follows inevitably from this that our knowledge will at best be incomplete, while at worst it will be wrong in every respect*" Dovers and Handmer [1993] on sustainability and defining the concept.

"*Sustainability is not something to be defined, but to be declared. It is an ethical guiding principle*" [cited in Peet, 1991].

2.0 Sustainability

2.1 The State of the World

In 1967 Lyn White Jr expressed his concern for the future of the Earth in his controversial article "*The Historical Roots of our Ecologic Crisis*"[1]. He reiterated what a number of others, both lay people and experts, were saying at the time; that the pursuit of material wealth and economic growth by the human species was threatening the survival of many of the other species and ecological systems on the planet. Later, others such as Ehrlich [1968], Odum [1969], Boulding [1970] and Ophuls [1973] also warned of an impending crisis. They referred to it as an environmental rather than ecological crisis, possibly so as to also explicitly include humans in the crisis. They recognised that the effects of many of these activities were not confined to ecological systems; increasingly they were also impinging on human social, economic and institutional systems.

Today, nearly 30 years later, the prospect of an environmental crisis appears to be even more real. In 1994 the Worldwatch Institute published its tenth annual *State of the World* [Worldwatch Institute, 1994]. The publication documents changes in the global environment throughout the 1980's and early 1990's. The

[1] The existence of such a crisis was assumed.

thinning of the ozone layer, problems of air, water and soil pollution, deforestation, the loss of species and diversity within ecosystems and signs of a possible climate change are just a few of many problems identified by Worldwatch. Their findings generally point to a significant deterioration of the planet and its ecosystems. Almost without exception, these changes are occurring at an ever increasing rate and are more extensive than measured in each of the previous years. Unfortunately, such unprecedented changes give credence to the theories which spell of an imminent environmental crisis.

Not everyone is in agreement on the causes or the extent of the crisis, whether we have actually reached crisis point or even whether a crisis exists at all [Young, 1990; Postel, 1992]. Despite this lack of certainty and hard data Mellor [1992] suggests that it is better to start from the assumption that there is an environmental crisis than to pay no heed to the indications. "*Experts may disagree about how, when and why it has, or will, come about but to most people the evidence is all around us*" [Mellor, 1992, p4]. By taking such a standpoint one is better placed to react to and cope with the crisis should it occur. She feels that if we do not take remedial action we will only have ourselves to blame.

Increasingly people are accepting that there is, or potentially could be, an environmental crisis[2]. What can be done about such a predicament? The majority of the world's population are unwittingly trapped into destructive and harmful forms of behaviour towards the environment [Mellor, 1992]. Our dependency on technology[3] often leads us to technological solutions. These are invariably temporary and tend only to address the symptoms of the problem. What is required are solutions in ecological or natural resource support systems which are permanent and address the cause of the problem [Boyden [1987] in Dovers and Handmer, 1993]. Changing current perceptions and patterns of behaviour appears to be both difficult and remote.

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[2] This thesis is also based on this assumption.

[3] Boyden (1987) describes it as our "techno-addiction".

A response to this bleak and apparently hopeless situation has been the emergence of a new awakening in environmental consciousness; a call for a new way of life that is both socially and environmentally good [Zimmerman, 1993]. Much of the basis for this optimism can be found in a "new" and "all-encompassing solution"; **sustainability**. It is felt that sustainability could potentially deal with a multitude of environmental, social and economic problems [Barbier, 1987; Kidd, 1992; WCED, 1987]. The concept has gained international acceptance and has been embraced by academics and practitioners from disciplines as disparate as political science, economics, ecology, forestry and sociology. In New Zealand it has become widely adopted as a management objective in many aspects of resource management. In both the Resource Management Act 1991 and the Forest Amendment Act 1993 the term *sustainable management* forms their primary purpose.

2.2 What is Sustainability?

Sustainability is to different people different things. It is frequently called a concept, an idea, a term or a notion. To those marketing consumer goods it is a fashionable slogan or something to be attached to in order to help sell the latest "environmentally friendly" product. To those involved in the environmental and conservation movements it is a fashionable buzzword [Pearce *et al*, 1990]. To academics working within institutions and their students it is often seen as a theoretical construct in need of greater definition [Miller *et al*, 1994]. Yet to others "*sustainability is a utopian vision of some future state in which people live and work in harmony with the biosphere*"; a state where humans are seen and behave as part of Nature rather than being seen as separate from and living outside of Nature [Miller *et al*, 1994, p76].

A distinction is sometimes made by some advocates whereby *sustainable management* is the process and *sustainable development* is the attainable goal [Dovers and Handmer, 1993; Jackson *pers comm*, 1994]. Such a differentiation is

not made within this thesis. The definition of sustainable development as the attainable goal or set of goals [Dovers and Handmer, 1993; Jackson *pers comm*, 1994] is not used as it is doubtful that sustainability can actually be "achieved". Those who believe that sustainability is an achievable set of goals or a predetermined end state at which some future point in time we will arrive at will invariably be disappointed. Often many of the goals of sustainability are conflicting or contradictory [Robinson, 1993]. Also the three generally recognised components of sustainability[4], ie economic, social and ecological (or biophysical] are constantly in a state of change and flux [Barbier, 1987]. By the time the aspired goals are met, if these can actually be agreed upon, the goal posts will invariably have shifted.

The term *sustainable development* is also avoided where possible because 'development' usually implies progress based not only on the use of but also the **increasing** use of resources. While some authors argue that the meaning of *development* is quite different from *growth* others believe the terms are synonymous [Pearce *et al*]. O'Riordian [1985], the IUCN [1991] and Sachs [1992] have all called sustainable development a "contradiction in terms". As the IUCN [1991] have pointed out, nothing physical can grow (or develop) indefinitely. Redclift also points out that "*By incorporating the concept of "sustainability", in an essentialist way, within the account of "development", the discourse surrounding the environment is often used to strengthen, rather than weaken, the basic supposition about progress*" [Redclift in Redclift and Sage, 1994, p21]. The term *development* creates additional confusion as it is more often than not used in relation to the undeveloped and underdeveloped countries. It tends to be used rather less in terms of the overdeveloped[5] world.

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[4]See Barbier (1987), Hayward (1990), Parliamentary Commissioner for the Environment (1994).

[5] The term *over-developed* is preferred when referring to first world countries. Most categorizations, with perhaps the north-south one as an exception, are heavily value-laden; with first generally being associated with the ideal. The north-south categorisation is not very helpful either, being geographically imprecise. The categorisation of the first world as over-developed attempts to redress the imbalance.

Some hold the view that sustainability is a conservation management strategy or set of practical techniques to achieve such a strategy. In order to cope with the on-going changes within the overlapping sets of economic, social and ecological systems sustainability needs to be a continuous, flexible, dynamic and meditative procedure rather than a blueprint set in concrete [Simon, 1989]. According to Miller *et al* [1994] sustainability "*is not some rigid goal we will either achieve or fail to achieve* .... (it) *is something that we have to strive for*" [Miller *et al*, 1994, p79]. As such it is probably more useful to construct sustainability as a **reflexive process**[6] rather than seeing it as an achievable goal or some predetermined end state.

Aldo Leopold wrote that "*there is as yet no ethic dealing with man's relation to land and to the animals and plants which grow upon it*" [Leopold, 1953, p218]. Perhaps sustainability is also the land ethic of which Leopold wrote. Much of what he talked about bears a striking resemblance to that which appears in the literature on sustainability today. In 1987, the World Commission on Environment and Development declared that in order to ensure the survival and well-being of the human species the concept of sustainable development required elevation to that of a global ethic [WECD, 1987]. As an ethic, sustainability implies that it is an imperative and it is something which we are morally obliged to do for our own sake and the Earths survival. As an ethic sustainability includes our values and belief systems about Nature as well as our scientific understanding of Nature.

Within this thesis the concept of sustainability is defined as both a reflexive process and an ethic. 'Sustainability' is also used in favour of 'sustainable development', 'sustainable management' or any other variant on the term. Sustainability appears to be the least value-laden and contradictory of the terms.

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[6] Reflexive process in this sense means that the process is constantly being reassessed in light of incoming information and adapted on the basis of this information. ie it is continuous, flexible, dynamic and meditative.

2.3 The Origins of Sustainability.

'Sustainability' first appeared as a major theme in Edward Goldsmith's *Blueprint for Survival* in 1974; however, the term 'sustainable development' was favoured. Six years later, 'sustainable development' appeared for the first time in a United Nations document; the *World Conservation Strategy; living resource conservation for sustainable development*[7]. The concept was not really popularised, however, until 1987 with the publication of the highly influential Bruntland report [Pearce *et al*, 1990]. Chaired by the Norwegian Prime Minister, Mrs Gro Harlem Bruntland, *Our Common Future* was the culmination of the World Commission on Environment and Development's work since its inception four years previously. In June of 1992 the United Nations Conference on Environment and Development was held in Rio de Janeiro. This event has since firmly secured the concept of sustainability on the international agenda. *Sustainable development* was the central philosophy surrounding the much discussed Agenda 21.

One may be lead to believe, through these recent events and the speed at which the idea has become widely accepted and influential, that the concept of sustainability is a new one. While the term may be new, the idea is not [Kidd, 1992]. Sustainability was necessarily a feature of all pre-industrial societies. With limited technology people had to live at a level of resource use equal to or below that which their immediate environment supplied. As Dovers and Handmer succinctly put it; they were "*limited by the metabolic processes of humans as biological organisms*" [Dovers and Handmer, 1993, p217]. The lack of technology meant it was difficult to go beyond those limits which Nature imposed. If these boundaries were breached the negative externalities of the resource use, or over use, impacted back upon those that were responsible for the violation. They responded accordingly in order to assume an uneasy equilibrium with their environment.

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[7] Its architects were the International Union for the Conservation of Nature and Natural Resources, Worldwide Fund for Nature and the United Nations Environmental Programme.

Today, in pre-industrial societies around the world commentators often refer to indigenous cultures, particularly in relation to tropical rainforest cultures, as having lived in harmony with their environment for many thousands of years [Caufield; 1985, Myers; 1990; Orr, 1992]. While such views are often held with a certain amount of romanticism it is hard to ignore that, in comparison to ourselves in the over-developed countries, pre-industrial peoples in developing and under-developed countries often appear to be able to take what they require from their environment without significantly depleting or damaging it. While they may not have an acknowledged word for it they appear to be practising sustainability.

Parallels can also be drawn within the New Zealand context. When explorers first arrived in Aotearoa from East Polynesia some one thousand years ago it is likely that they found a land where the natural resources appeared not only to be bountiful but also limitless. Later, with a growth in population and the development of technology (notably the capability to utilise green stone), pressure was placed on these resources and in some cases over-exploitation resulted. Fires often ravaged the landscape, especially in the drier eastern areas of the country, and during this period a number of bird species met their demise [McKelvey, 1995]. The evidence points to such events as being more prevalent during the first 500 years of Polynesian habitation [O'Regan in Ralston, 1994]. In response to the degradation of the environment and resource base important lessons were learnt. Resource management philosophies, concepts and techniques were, thus, developed out of a need to ensure that society stayed within the limits imposed on them by their environment [O'Regan in Ralston, 1994; Mason, 1994].

Sustainability also has historical roots in the Western scientific traditions of energy analysis, classical economics and others [Dovers and Handmer, 1993]. Within the forestry discipline the concept of sustained yield first appeared in legislation with the French Forest Ordinance of 1669 [FAO, 1993]. In the early 18th century the concept of sustained yield or *Nachhaltigkeit* was developed and further refined in the German school of forestry [Kehr, 1993]. Some practitioners

claim that, in fact, the concept of sustainability is the principle basis of the forestry discipline and that sustainability has been around as long as forests have been actively managed [Studholme in Ralston, 1994].

Charles Kidd wrote a paper in 1992 on the evolution of the contemporary concept of sustainability entitled *The Evolution of Sustainability*. His thesis was that since the late 19th century six strains of sustainability have developed separately. Each represents a distinct lineage and school of thought. They are not necessarily compatible and may even be contradictory [Simon, 1989]. Kidd's six roots of sustainability are briefly described below. (In Chapter 3 they explored in greater depth).

1 The "**no growth-slow growth**" root. Concerned about the validity of continuous economic growth as a goal for society. The major theme of Nicholas Georgescu-Roegen's [1971] book *The Entropy Law and the Economic Process* is that the fundamental laws of thermodynamics make a steady state economy inevitable.

2 The **resource/ environmental** root. Initially concerned about the adequacy of resources then shifted to a concern over deterioration of the environment.

3 The **ecological/ carrying capacity** root. Concerned with physical phenomena, such as land availability, population levels and growth rates, environmental degradation, reserves and national parks.

4 The **critique of technology** root. Concerned about high-energy, high-technology systems of food and fibre production and calls for appropriate technology, technology linked to the service of the environment and practices which make light demands on natural resources.

5 The **ecodevelopment** root. Concerned mainly with social issues such as the equity of economic systems, health, arms, employment, poverty, self-sufficiency, values and 'grassroots' participation but also tied into the conservation of

resources and protection of the environment. Questions the assumption that individual responsibility can resolve environmental problems which are essentially collective problems.

6 The **biosphere root**. Concerned about the increasing scale of the human species as an agent of global change as well as issues of intergenerational equity and justice.

2.4 Problems in the Conceptualisation of Sustainability

Despite a widespread focus on sustainability as an all-embracing solution to our environmental problems there is no universally accepted definition or interpretation of it [Barbier, 1987]. This is probably a function of its various and disparate historical roots. There are a number of definitions of sustainability which reflect the values and objectives adherents regard as important [Milesell, 1992]. While sustainability is generally understood to be about the wise management of the Earth's natural resources there are numerous interpretations of the meaning and implications of the concept. This has lead to an outpouring of definitions each one attempting to have greater analytical rigor or be more "correct" than its predecessors.

In 1987 the Bruntland Report defined sustainability, thus: "*Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs*" [WCED 1987, p8]. The WCED's definition focused on growth and societies as being pivotal to a sustainable world. They felt that what was needed was a new era of economic growth, one that needed to be based on *policies that sustain and expand the resource base* [WCED 1987, p1]. Whilst the Bruntland report was widely acclaimed, its position and definition of sustainability did, however, receive a degree of unfavourable criticism.

The International Union for the Conservation of Nature and Natural Resources (IUCN) responded by saying that sustainable growth and its implications were a contradiction in terms; that *nothing physical can grow indefinitely* [IUCN 1991, p4]. Their alternative interpretation described sustainability as a way *to improve the quality of human life while living within the carrying capacity of supporting ecosystems* [IUCN, 1991, p4]. The IUCN's interpretation similarly focused on the wellbeing of humans as a key to sustainability. However, it also acknowledged that there are limits to growth and that biological systems are at least as important to sustainability as any economic system.

These two commonly cited interpretations of sustainability demonstrate the reason why a universally accepted definition has not been found. The two definitions have their roots in different schools of thought and it is difficult to build a compromise without weakening one or the other's position. Each school of thought has tended to link their own particular set of values to certain definitions; with each definition attracting its own sustainability idiom. For example, "sustainable growth" is linked to economics, "sustainable development" to development studies, "ecological sustainability" to ecology and "sustained yield" to fisheries and forestry.

At best these various terms are contradictory or ambiguous and at worst they can be misleading. It has been argued that the concept has been appropriated by the various disciplines and constructed into their own versions of what sustainability "is" [Buttel and Gillespie, 1988 in Lélé 1991]. John Young [1990] described sustainable development as a kind of Orwellian doublespeak by simply giving economic growth an organic face. Michael Redclift [1994] goes further and claims that the discourse surrounding sustainable development is often used to strengthen the assumption that 'progress is good' (progress being defined in terms of increased economic growth) rather than questioning the legitimacy of such an assumption. Appropriation of the concept appears to have led to an inability or unwillingness, on the part of some, to acknowledge alternative interpretations of sustainability. In turn this has lead to people talking past each other while thinking that they are talking about the same thing. Rather than enlighten, the

many definitions and attachments to the term tend to aid any confusion and confuse any clarity. Through confusion and appropriation past "unsustainable" practices are essentially able to continue under the guise of a new rhetoric [Lélé, 1991].

Simon [1989] argues that a far broader reconceptualisation of sustainability is required in order for theory and praxis to be meaningfully linked and realised. He feels that *we need a definition which is not only analytically rigorous but also of practical utility* [Simon, 1989, p44]. While most analysts would agree with Simon's sentiment some have come to a realisation that a precise and all inclusive definition of sustainability probably does not exist. To try and find one will not only be difficult but also futile [Blaschke *et al* in Henriques, 1991; Kidd, 1992; Miller *et al*, 1994]. All definitions are in some way inadequate. Any definition will be clouded by a narrow range of understanding and contain inherent biases depending on who is creating the definition [Dovers and Handmer, 1993]. Such a situation can lead to friction, disagreement and polarisation especially if other definitions are not acknowledged as being valid. On the other hand Redclift [1994] believes that one of the strengths of sustainability is this cloudiness and ambiguity; the confusion in its meaning creates healthy discussion and allows for a variety of narratives to be told.

2.5 Barbier's Model of Sustainability

Rather than attempting to describe sustainability and its characteristics through a questionable "perfect definition", some authors have found it more fruitful looking at sustainability through alternative mechanisms. One of these is an interpretation of sustainability developed by Edward Barbier. Barbier illustrated sustainability through a conceptual framework or a model. He found it to be more of a useful analytical tool than any single definition. The model first appeared in

1987 in an article entitled *The Concept of Sustainable Development*[8] [Barbier, 1987]. Since this time has been widely applied. The model gained international acceptance at the Earth Summit in Rio de Janeiro in 1992. It has also featured at the national level; the Sustainable Land Management Conference at Lincoln University in 1994 being a recent example.

Barbier developed his conceptual model in terms of '*sustainable development*' but since this time it has been applied to what is considered to be a more holistic concept of '*sustainability*'. The model was initially created with developing and underdeveloped countries in mind but now is also applied to the overdeveloped countries.

Barbier's model of sustainability is illustrated below in Figure 1 [from Barbier, 1987, p104]. Barbier contends that sustainability is a process of interactions among three systems: the biological and resource system, the economic system, and the social system. Each of these systems has a unique set of human ascribed goals. The following examples of goals are given for each of the systems.

" ***Biological system goals:***

- genetic diversity

- resilience

- biological productivity

Economic system goals:

- satisfying basic needs (reducing poverty)

- equity-enhancing

- increasing useful goods and services

Social system goals:

- cultural diversity

- institutional sustainability

- social justice

- participation " [Barbier, 1987, p 104].

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[8] Barbier is rarely acknowledged as the architect of this model.

Barbier argues that the general objective of sustainability is to maximize the goals across all these systems as represented by the shaded area in Figure 1. He acknowledges that it is not possible to maximise all goals all of the time, therefore, an *adaptive process of trade-offs* is required.

This model is a particularly helpful view of sustainability and its characteristics. It begins to overcome many of the problems of previous definitions. It allows other rationalities and interpretations of sustainability to be located in the model and acts as a mechanism by which alternative interpretations can be legitimised or questioned, both at a theoretical as well as a practical level.

Figure 1. Barbier's original model of sustainable development [Barbier, 1987, p104].

2.6 Barbier's Model of Sustainability Expanded

Barbier acknowledged the limitations of his model and intended it only to form the basic steps for the development of a new methodology in the application of the concept of sustainability to real world situations [Barbier, 1987]. To misquote Simon [1989]; what is required is a conceptual model, which is not only analytically rigorous but also of practical utility. The whole of the next chapter is dedicated to the expansion of the existing model in an attempt to improve its clarity and analytical rigor. First, however, a number of points of critique can be made in order to improve the model on a relatively shallow semantic level.

The first point is that it should be acknowledged that the three systems do not exist as separate entities. They are scientific constructs formed in order to categorise and simplify and make understanding easier. In reality no "system" exists without the other. There are no economic systems which exist beyond Nature and her resources. While it could be argued that there are some ecosystems and species which exist outside of the influence of all social and economic systems it is difficult to cite examples. Most natural ecosystems have in some way been influenced by the other systems ~~in some way~~. Similarly, economic systems and biological systems all exist within social, cultural and political contexts.

The second point of critique is Barbier's use of the word 'system' when describing the biological, economic and social parts of the sustainability equation. The Ministry for the Environment in its 1993 publication, *Living for the future: a guide to Agenda 21*, replaces the term *system* with the term *dimension*. In this thesis dimension is the preferred term. A dimension appears to have greater depth to it and is inclusive of those aspects which may commonly thought to be outside of a system. Examples may be values (both human and intrinsic[9]), philosophy, spirituality and ethics.

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[9] Intrinsic values are those values which species have of themselves regardless of their importance to and cognizance by humans.

Another semantic point is Barbier's use of the phrase *biological and resource* system. The term bio-physical is used in preference to these terms not only to be more concise but also to be more inclusive. Like the biological and resource dimension the bio-physical includes plants and other organisms (the biological) and things that have a utilitarian value to humans (the resource). However, in an expanded model of sustainability the bio-physical specifically includes the abiotic (soils, climate, water, etc) in the dimension.

The fourth point of critique is Barbier's location of Marxist economics and conventional economics in the model. Both these forms of economics assume that the notions of progress, growth and development are implicitly good [Ophuls, 1990; Daly and Cobb, 1994; Martell, 1994]. Similarly both doctrines have little regard for the role of natural resources in the economic process [Barbier, 1989]. Conventional economics sees a resource only having value if it is used or useful to humans [Randall, 1987]. Marxism sees resources as having a value only when that value is due to human labour [Barbier, 1989]. While their motivations may be different both forms of economics fail to question such underlying cornucopian and anthropocentric assumptions. The environmental outcomes for both forms of economics have been similar; neither economic system can claim to be more sustainable, in terms of the environment, than the other [Martell, 1994]. These observations compelled Dudley Seers to locate Marxism and standard Western economics close together in a chapter entitled "Marxism and other Neo-Classical Economics" [cited in Daly and Cobb, 1994]. In a reconceptualised model both forms of economics are, thus, reclassified as neoclassical economics and relocated on the periphery of the economic dimension (see Figure 2 overleaf).

Although Barbier emphasises the dynamism of the three dimensions of sustainability, using words and phrases such as *an ongoing process, (adaptive) transformations* and *interactions*, the dimensions are depicted as being symmetrical, fixed and of a single dimension. While this is obviously the easiest way to present the model, it should be highlighted that all three dimensions are in a continual state of flux or dynamism. As a consequence the shaded area of

"sustainability" in the centre of the model is similarly constantly changing size and shape and this helps to explain why sustainability can never be 'achieved'.

Figure 2. Barbier's reconceptualised model of sustainability at the semantic level.

The final point of criticism, and the most important in terms of further developing this model, is that Barbier has illustrated each dimension as if they were single entities. In fact, there are a number of subsets within each dimension. In the economic dimension neo-classical economics has already been identified, however, resource economics, environmental economics and ecological economics are others which can also be located within the model. Some of these schools of thought have more to say and can be seen to be positioned closer to the shaded "sustainable" area than others. The same is also said of the other dimensions. It is argued in the next chapter that those schools of thoughts on the extremities of the dimensions tend towards the Modern and those closest to the centre towards the Postmodern.

"For humans again to participate in, rather than mine, Earth's ecosystems, most of our lately accustomed ways - of thought, perception, society, tenure, and livelihood - will have to be radically reshaped towards sustainability" [Mills in Vandruss *et al*, 1990, p*vii*]

3.0 A Reconceptualised Model of Sustainability

In the last chapter Edward Barbier's 1987 model of sustainable development was reviewed and semantic changes were made in an effort to improve upon it. These included substitution of the word *sustainability* in place of *sustainable development*, changing *systems* in favour of *dimensions*, and relocating both Marxist economics and conventional economics to a position collectively called *neo-classical economics*. Further, it was pointed out that the model of sustainability is not inert and two-dimensional as drawn, but dynamic and three-dimensional. In this chapter a deeper reconceptualisation of the model is undertaken. Such an exercise not only helps to make the concept of sustainability and its contradictions clearer but primarily it creates a **framework for analysis**.

While Barbier's model is increasingly being used to gain an understanding of sustainability it is rarely pointed out that the meaning and interpretation of each dimension within the model is not universal. It needs to be highlighted, then, that what is understood to be meant by the economic, bio-physical and social dimensions can be quite different from one person to the next depending on their own worldview. The disciplines which have constructed each of these dimensions did so out of a need to solve their part of the sustainability problem, however it must also be recognised that their ideas did not originated from the same source nor did their ideas remain static. It is argued that over the last one hundred years or so it appears that there has been three major waves of ideas within Western thought which have permeated and influenced the development of each of the three dimensions.

Each wave has tended not only to generate new ideas but also new disciplines (or sub-disciplines) and popular movements. With the help of Charles Kidd's six roots of sustainability, these sub-disciplines and movements can be located in a reconceptualised model of sustainability (see Figure 3 below).

Figure 3. Barbier's reconceptualised model of sustainability

The waves are indicated by the dotted line. The waves of ideas and disciplines within them are not absolute classifications. In reality the boundaries are much

more blurred. It is more like a continuum of ideas with each idea challenging the preceding one. The direction of the arrows indicates the direction of movement of the waves. I argue that the each successive wave of ideas is closer to what sustainability is "about" than the preceding wave. This is not to negate the former ideas and their importance; they are part of and give meaning to the later ideas.

Through this process of location a reconceptualised model is built upon the existing model. It is believed that the new model should enable improved analysis of particular natural resource management projects and problems. Not only will the model form a framework for analysis but it should enable individuals and disciplines to locate themselves in the model and see where their own philosophical perspective lays in relation to others. Such a process should help to either legitimise or challenge their present philosophical standpoint or give them an insight into the standpoint of others; standpoints which they might not even had thought existed. From there possible directions for change may be made clearer.

Each root has a particular perspective on sustainability which is highlighted by its own 'sustainability expression' ie the sustainability expression for the Resource/environmental perspective is *sustainable yield* (see Figure 4 overleaf). In this chapter, a brief account of each perspective is given.

In Chapter 5 the reconceptualised model is used to examine a case study of indigenous forestry in New Zealand. In Chapter 6 it used to help with an analysis of the political levels of policy, legislation and research surrounding indigenous forestry in New Zealand today and in the recent past. This will enable the model to be tested at both the micro and macro levels.

Root of Sustainability[1]	Dimension	Favoured Term
The "no-growth slow growth" Root	Economic	Economic Sustainability
The Resource/ Environmental Root	Economic/ Biophysical	Sustained Yield
The Ecological/ Conservation Root[2]	Biophysical	Ecological Sustainability
The Critique of Technology Root	Biophysical/ Social	Appropriate Technology
The Ecodevelopment Root	Social	Sustainable Development
The Biosphere Root	Social/ Economic	Intergenerational Equity

Figure 4. The six dimensions of sustainability along with their corresponding roots (as identified by Kidd [1992]) and terms which are generally used to describe them.

3.1 Economic Sustainability[3]

Neo-classical economics is founded on the understanding that economic growth is inherently "good" and that their are no limits to resources or growth [Ophuls, 1990; Daly and Cobb, 1994; Martell, 1994]. Both John Locke and Adam Smith, the two intellects on whose work much of neo-classical economics originates, made cornucopian assumptions of ecological abundance [Ophuls, 1990]. These assumptions continue to be supported by what Cleveland [1991] calls the "*twin pillars of the neoclassic economic model of resource scarcity* (these being) *Hotelling's [1931] theory of optimal depletion and Barnett and Morse's [1963] empirical analysis of resource scarcity in the United States*" [Cleveland in Costanza, 1991, p292]. The neoclassical rationale goes like this. As a resource

[1] After Charles Kidd [1992].

[2] Kidd's [1992] described this root as the Ecological/Carrying Capacity Root, however, this has been changed to be inclusive of conservation which is seen as a separate root of sustainability but is also located in the Biophysical Dimension.

[3] Also referred to as sustainable growth particularly within the neo-classical paradigm.

becomes more scarce it becomes more expensive due to increases in extraction costs and/ or rental payment to resource owners. These price rises, in turn, stimulate attempts to 'expand' the resource base through measures such as exploration, recycling, substitution, more efficient utilisation of the resource and most importantly, according to the neoclassical paradigm, "*technical innovation in resource exploration, extraction, processing, and transformation into goods and services.* (Further, within) *the neoclassical model, long-run resource scarcity impinging on economic growth is a near impossibility because rising scarcity is assumed to automatically sow the seeds for its amelioration*" [Cleveland in Costanza, 1991, p292]. However, Cleveland suggests that recent econometric studies tend to confirm that the conclusions which Barnett and Morse reached overly optimistic. Redclift [1994] suggests that such neoclassical assumptions effectively constrains the dominant economic paradigm from dealing with intergenerational issues in particular.

Neo-classical economics is also based on the concept of the self-maximising economically rational consumer or the "economic man" whose main feature is an insatiable and escalating consumption of commodities [Plumwood, 1993]. According to Ted Wheelright "*its methodology of concentrating on individualism ignores the reality of community*" [in Rees *et al*, 1993, p18]. Under this paradigm "*there is no longer any society, any social rights or needs, only the individual worker/consumer, his family and the market*" [Mellor, 1992, p11]. Neo-classical economics assumes that individuals make decisions based simply on their own needs and desires and that they value things in a completely economic rational way. Kumar [1995], however, argues that people are 'innately inconsistent', or rather, individuals make decisions based on their own unique and complex set of rationalities not on a "textbook" economic rationale. According to Redclift [1987] the imaginary mechanistic world which neo-classical economists have constructed struggles to deal with the surprises, uncertainty and complexities of the social and natural environment. This makes the understanding of the sustainability within the context of neo-classical economics inherently flawed. Sustainability is concerned with the integration of many rationalities not just a single economic one

[Barbier, 1989; Hayward, 1990].

With the widespread rise in the consciousness of environmental issues some economists have been trying to take the environmental rationales into consideration in their analyses. This has lead to the establishment of a new discipline, or rather sub-discipline, called ***environmental economics***. In neo-classical economics[4] generally only those things which have a tradeable value in the market place are assigned economic value[5]. As such, the environment has often been assigned a zero value [Waring, 1988; Redclift, 1987]. For example, forests are generally valued on the monetary value of any merchantable (or potentially merchantable) timber on the land[6]. Any other functions that forests provide, such as water and soil conservation, wildlife and biodiversity values, and recreation[7] and intrinsic values are not included in neo-classical cost-benefit analyses. A major goal for environmental economics, therefore, has been on finding ways in which such environmental values can be included into the framework of quantitative economic analysis [Pearce *et al*, 1989; Barbier, 1989; Costanza, 1991; Shaw, 1991].

Related to the inclusion of non-market values in project analysis by environmental economics is the inclusion of externalities in project appraisal. Externalities are those effects which extend outside of or beyond a project and impact upon people, ecosystems or the wider environment. Externalities can have beneficial or adverse affects but it is typically the negative effects of projects which are not included in neo-classical economic analysis. Such incomplete analysis can lead to externalities impacting negatively upon both people and the wider environment outside of the project. For example, a forestry operation which increases the silt load into a river

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[4]Also called conventional economics, orthodox economics and economic rationalism (Rees *et al*, 1993).

[5] See Manley in Hammond (ed), 1995 for an illustration in terms of forestry.

[6] See B.R Manley in D. Hammon (ed), 1995 for forest valuation techniques.

[7] Unless directly paid for.

as a by-product of its operation will probably record a positive value in its own and the national accounting system. However, negative externalities which impact upon other people or the environment, such as to fishers or fish downstream, are usually not included as a negative value within the neo-classical economic paradigm. Environmental economics attempts to redress this imbalance by placing market values on costs to the environment. In simplified terms for this example, a cost would be placed on the loss of fish and satisfaction by fishers, and this then subtracted from the benefits of the forestry project to get a more accurate measure of its total economic value.

Much of the effort by environmental economists has been in developing economic instruments for measuring non-market values so that such "market failures" and "resource mis-allocations" can be avoided[8]. A number of economic instruments aimed at internalizing environmental externalities have also been developed; some of which are aimed at making the industry, which cause the externalities, pay for their amelioration while others are aimed at creating incentives for industry to avoid the creation of such externalities[9]. While such an approach is considered to be more favourable to the environment than those approaches which assign it a zero value or do not take external costs into account, environmental economics has receive some unfavourable criticism [Redclift, 1987; Gowdy and Olsen, 1994; Rosewarne in Rees *et al*, 1993].

The main criticism of environmental economics is that it is grounded in many of the same assumptions as neo-classical economics. It fails to take into account the physics and ecology of the world in which we live [Peet, 1991]. It assumes that the environment is a commodity for which a market can be found and prices can be determined. The problem is seen as quantifying and measuring the human concern

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[8] Examples of such mechanisms are contingent valuation, travel-cost method, land-value method and the hedonic price method. See G.N Kerr [1986] ***Introduction to Non-Market Valuation: Theory and Methods*** for examples.

[9] Examples are quota systems for fisheries, carbon taxes and tradeable discharge permits.

for the environment. Some authors have argued that it is not possible to place a market value on many aspects of the environment, or even if one could, the environment is too important, even immoral, to be treated like any other commodity [Norgaard cited in Redclift, 1987; Peet, 1992]. Using cost-benefit analysis (a tool commonly used in neo-classical and environmental economics for evaluating projects), it can be highly 'economic' to save money today by leaving major problems for future generations to solve [Peet, 1992].

The dissatisfaction by some with environmental economics has seen the emergence of an alternative examination of economics and the environment, namely ***ecological economics*** [Costanza, 1991; Shaw, 1991; Rosewarne in Rees *et al*, 1993; Gowdy and Olsen, 1994]. Ecological economics not only challenges the main assumptions of neo-classical economics but also the very foundation on which it lays - that economic growth is inherently good. Ecological economics, in the words of Gowdy and Olsen recognises "*the limitations of marginal analysis, the ethical dimensions of economic analysis, and the folly of making irreversible decisions about the environment in the face of overwhelming uncertainty. As Georgescu-Roegen argues, the challenge of economic decision making is not to maximise utility but to minimise regrets.*" [Gowdy and Olsen, 1994, p170].

Out of this questioning of the legitimacy of neo-classical economics Nicholas Georgescu-Roegen became the first to advocate a "no growth" philosophy in his [1971] book *The Entropy Law and the Economic Process*. His major theme was that the fundamental laws of thermodynamics make a no growth economy inevitable; nothing can grow infinitely. Redclift also challenges the economic growth imperative on the grounds that it represents the ultimate externality; 'global environmental change' [Redclift in Redclift and Sage, 1994]. World Bank economist Herman Daly has also been a prominent exponent of the 'no growth' school of thought from his first book *Towards a Steady State Economy* [1973] through to his most recent *For the Common Good; redirecting the economy toward community, the environment, and a sustainable future* [Daly and Cobb, 1994, 2nd edition]. He and other ecological economists advocate sustainability as a binding

criteria for economic analysis, a reassessment of the standard measures of economic activity and to take into account the drawdown of environmental assets. Robert Costanza advocates giving priority to natural systems over items which measure conventional growth [cited in Shaw, 1991]. Kidd [1992] sees that the radical "no growth" philosophy initially advocated in the early 1970's, by both Daly and Georgescu-Roegen, as having been superseded within ecological economics to a change to a "steady growth/ different kinds of growth" philosophy. However, others still see a no growth paradigm as the most viable option [Costanza, 1991; Goodland, 1992; Turner *et al*, 1994].

Whilst doubt has been cast on the "sub-discipline" of environmental economics and its construction of reality, Rosewarne still feels that ecological economics as an alternative is still inherently enigmatic. While it does question the notions of progress and growth "(b)*y and large, ecological economics is still defined within the neoclassical problematic and, generally, does not challenge the confidence in market and pricing mechanisms.*" [Rosenwarne in Rees *et al*, 1993, p56]. A more radical proposition espoused by Norgaard [in Redclift, 1987] is the abandonment of an economic paradigm that places unitary values on the environment. The implication being "*that economics can only handle environmental factors successfully if it breaks free from its mainstream epistemology.*" [Norgaard in Redclift, 1987, p41]. The question must be posed, however, if the present environmental and ecological economic techniques are to be abandoned in favour of those which may be closer to an integrative model of sustainability what form will these techniques take and how can they operate in practice?

3.2 Sustained yield

Within the resource/ environment root of sustainability the historical concern has been over the adequacy of renewable natural resources to supply present and future human demands or "the problem of natural-resource scarcity and depletion" [Barbier, 1989]. This concern is based on "*the fact that a biological resource stock*

cannot be exploited too heavily without an ultimate loss of productivity" [Clark, 1976, p1]. The understanding of the problem of natural resource scarcity and depletion and the models developed to maintain productivity of renewable resources have largely been based on a concept called *sustained yield*[10]. Sustained yield is built on a mathematical model of biological growth that assumes that at any given population level a surplus exists that can be harvested in perpetuity without altering the stock level [Clark, 1976].

Although the problems of scarcity and depletion (in particular such things as sustained yield, renewability, irreversibility, optimal allocation and environmental limits) had been discussed previous to this time an upsurge in research and analysis began to occur during the late 1950's. Since this time and as a result of this focus another sub-discipline of economics emerged and has come to be known as ***resource economics***. A number of mathematical models have been developed by resource economists to help understand the problems of natural resource scarcity. With this, upsurge in interest the focus shifted from sustained yield to refined forms of the concept such as *maximum sustainable yield* and *optimal sustainable yield* [Clark, 1976; Rosenberg *et al*, 1993].

Resource economics has attempted to link economic models with biological models in order that decisions may be made with greater rationale, however, like environmental economics it has not failed to escape criticism. For example, Colin Clarke identified three fundamental problems with the maximum sustainable yield (and by inference sustained yield) concept. First he saw the concept "yield" as an impossible goal especially in cases where several ecologically interdependent species are being harvested. Wherever more than a single species is trying to be sustained (either for preservation or utilisation purposes) the maximisation of yield for each species separately is clearly impossible [Clark, 1976]. Secondly Clark points to the word "sustainable" being equally problematic when dealing with

[10] In terms of the discipline of forestry it has been claimed that the goal of sustained yield has been around for as long as forests have been actively been managed (Studholme in Ralston, 1994). The concept has appeared in legislation as far back as 1669 with the French Forest Ordinance (FAO, 1993).

"renewable" resources. The population and age classes within a resource are sometimes subject to large and unpredictable fluctuations. A yield at one population level may not be possible to sustain if a population or the structure of a population changes to another. Thirdly, Clark points to the fundamental flaw of sustained yield being that it only takes into account the benefits of resource exploitation and completely ignores the cost side of cost-benefit considerations. He says that "*it is extremely unlikely that in any particular case a maximum sustainable yield harvest policy will prove to be optimal in an economic sense*". He carries on to say "*this fundamental flaw means that the maximum sustainable yield concept is virtually useless for descriptive theories of renewable resource exploitation*" [Clark, 1976, p2].

An alternative view of the problem of natural resource scarcity has evolved since the 1960's and has found its own niche in what sometimes has been called ***bioeconomics***[11] [Clark, 1976]. Bioeconomics developed out of the recognition that while the mathematics and models may have been 'correct' many theoretical solutions of resource scarcity were not proving to be sustainable [Rosenberg *et al*, 1993]. So while bioeconomics is also based on mathematical modelling it differs substantially from the more conventional perspective of classical resource economics. Increasingly it has included "non-economic" influences into its analysis such as thermodynamics, ecology and human values in an attempt to cast the net wider and place a greater range of rationalities into its models [Barbier, 1989].

Economics has often looked to physics for theoretical and methodological inspiration. The first law of thermodynamics[12] has supplied some economists [Georgescu-Roegen, 1971; Meadows *et al*, 1972; Ophuls, 1990] with a methodology which allows the economic system and the environment to be viewed together as

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[11] More often than not *bioeconomics* is simply called *alternative resource economics* (See Barbier, 1989 for example). To confuse things more Michael Redclift (1987) has also used the term bioeconomics to describe environmental economics.

[12] The first law of thermodynamics states that energy matter is neither created nor destroyed but rather transformed [Randall, 1987; Ophuls, 1973].

a closed circular system of energy and material transformation. The second law of thermodynamics[13] can be seen as an analogy of the process as an irreversible transformation of ordered, useful (low entropy) material and energy into dissipated and therefore useless (high entropy) waste [Barbier, 1989]. These laws of thermodynamics have been used in bioeconomics to form a basis for greater understanding of waste, scarcity and depletion of natural resources.

The discipline of ecology is likewise integral to the "subdiscipline" of bioeconomics. It has furthered scientific understanding of ecological relationships and processes and how they are affected by human activity [Barbier, 1987]. Ecologists attempt to understand the complexity and diversity of these relationships and processes often through the use of mathematical models. Such models have consequently been used and further refined by bio-economists to understand the resource scarcity/ depletion problem and attempt to provide "solutions".

Some environmentalists have argued that resource scarcity and its consequences do not exist in a vacuum removed from the values, welfare and lives of people. Bioeconomics has included in its modelling the dynamics and processes of physics and ecology. However, it has been recognised that its ability to include social, moral and philosophical arguments has been limited. This is not surprising because of the difficulty (and some would argue the morality) of quantifying such phenomena. One of the consequences of such a limited perspective is that resource economists (even bio-economists) may regard as economically rational the 'complete' depletion or destruction of a resource or ecosystem [Clark, 1990; Rosewarne in Rees *et al*, 1993; Daly and Cobb, 1994].

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[13] The second law of thermodynamics (the entropy law) states that the energy matter in a closed system is transformed from more to less available states [Randall, 1987; Ophuls, 1990]. This process of transformation occurs in nature but is accelerated by the production and consumption activities of humans. This accelerated transformation process incurs environment costs and depletes both renewable and non-renewable resources.

3.3 Ecological Sustainability[14]

The *ecological / carrying capacity* root identified by Charles Kidd [1992] can be located in the model within the biophysical dimension of sustainability. The root has its origins in the 1890's with the work of the founders of ***ecology***, Ernest Haeckel and Eugenius Warming, and their desire to understand natural systems [Mellor, 1992; Worster cited in Soulé and Lease, 1995]. The discipline of ecology saw attention placed upon holism in its quest for knowledge and the use of analogies from the social sciences in describing itself [Ophuls, 1990]. This was a radical departure from the approach of the other natural sciences which favoured the reductionist, mechanistic approach of Modernist science. Science had traditionally constructed Nature as passive, infinite and available for exploitation, however, the science of ecology saw Nature as an interconnected and limited system [Mellor, 1992]. Because of these departures from mainstream science, ecology was, and is probably still, regarded as the "subversive science"[15] [Hargrove, 1989; Steverson, 1994]

The essential unit of ecology is the ecological system or the ecosystem. The primary concerns of the discipline are "the whole" and the inter-relationships of Nature [Ophuls, 1990]. Much of the research within ecology up until the early 1960's was concerned with attempting to understand these relationships (or as Ophuls described them, "Nature's economy"). Previous to this time ecology had tended to be studied in terms of the Nature only, rather than in terms of the Nature - human relationship. Applied ecology was generally confined to studies within certain "pristine" or "wilderness" environs. From the 1960's on ecology began to include humans in it analyses. It also started to question theories of

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[14] This root of sustainability has been renamed because it was felt that the biophysical dimension has more than one root. It has a connected root in the area known as *nature conservation*, hence the ecological/nature conservation root.

[15] This characterisation of ecology comes from Paul B. Sears' article , *Ecology - A Subversive Science* in ***Bioscience*** 1964, Vol.14 No.11. It was later popularised largely due to Paul Shepard's ***The Subversive Science: Essays toward an ecology of man***, Houghton Mifflin, Boston, 1969 [cited in Steverson, 1994].

progress based on industrialisation [Kumar, 1995].

Another root of sustainability, that of ***nature conservation***[16], can also be located within the same biophysical dimension as the ecological root. The root developed not so much out of a desire to understand Nature, as did ecology, but more out of a concern for the conservation of it. While strands of this root were developing with a number of American and European artists and writers of the Romantic and Transcendental movements in the first half of the nineteenth century, Sale [1993] contends that the start of the nature conservation movement did not fully begin until the work of a series of American naturalists and activists around the turn of last century. Zimmerman [1993] identified two main strands of the nature conservation root (although he terms it anthropocentric reformism). One was *resource conservationism* which was formalised both by Gifford Pinchot (first head of the U.S Forest Service in 1905) and Theodore Roosevelt. Resource conservation has obvious links to resource economics and they can be located closely together in the model. The other strand was *preservationism* and which is often attributed to John Muir (a founder of the Sierra Club in 1892) [Hargrove, 1989; Sale, 1993; Mazzotta and Kline, 1995]. Preservationism is generally associated with the preservation of wilderness (for non-use values) while resource conservation tends to be about conservation for utilitarian purposes. However, Zimmerman classifies them together because he sees that they are both philosophically anthropocentric and they both advocate reforming current institutions and practices rather than creating radical change.

In 1962 Rachel Carson's detailed and powerful condemnation of the American pesticide industry, *Silent Spring*, was released. The angry and uncompromising words within this book heralded the beginning of the environmental movement [Sale, 1993]. It met with immediate and popular success with a significant number of academics and lay-people. Other books and articles soon followed which also emphasised the effects of humans both on the environment and on one another.

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[16] This root was not identified by Charles Kidd in his *Evolution of Sustainability* (1992).

With the advent of ***environmentalism***[17] the conservation movement and the science of ecology become fused [Sale, 1993]. The environmental movement took "*the conceptual apparatus and terminology of the "subversive science" to support and give voice to their normative concern for humanity's relationship to and treatment of nonhuman nature*" [Steverson, 1994, p71].

Such a fusion had dramatic implications both for the science and the movement. A new branch of ecology, that of environmental science, became established. It recognised that people were part of Nature and its ecosystems, therefore, humans and their effects on the environment should be included in scientific study. While environmental science was dependant on ecology for much of its information it favoured a less descriptive and more applied approach than its counterpart. It acknowledged that ecosystems operate within social, cultural and political contexts. The scope of ecology also broaden as well. No longer was the discipline's concerns limited to ecosystems of a "pristine" nature but it also included modified ecosystems, the biosphere, biological diversity and human ecology.

Environmentalism, by and large, rejects an anthropocentric construction of the world and questions the idea that humans are entitled to impose their values on Nature [Mazzotta and Kline, 1995]. Instead environmentalism prefers to construct the world either within a biocentric or an ecocentric context. Put simply, biocentrics reject the claim that humans are superior to other species [Taylor, 1983 cited in Mazzotta and Kline, 1995]. Ecocentrism is a broader philosophy, which includes biocentrism, and challenges the view that humans are superior to all of Nature and its ecosystems. Zimmerman defines the basic aim of the followers of environmental ethics (or environmentalists) as granting "moral considerability to non-human entities" [Zimmerman, 1993].

Environmentalism provides a connection between conservation and the negative externalities and "diseases" which are being generated by a Modern affluent

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[17] Zimmerman [1993] classifies environmentalism as *environmental ethics*. Naess [1989] describes environmentalism as *shallow ecology* or *shallow environmentalism*.

society. "Environmental issues" such as loss of biodiversity, pollution, ozone depletion and pesticides and "social issues" such as drug abuse, violence and alienation have become linked and politicised [Sale, 1993]. Out of these concerns in many countries today environmental and resource management legislation has been generated in order to help alleviate such problems. Environmental issues are now prominent on many political and community agendas and it appears that the "greening" of the planet is beginning to take place. However, a number of people are less confident that real change is occurring. Despite the environmental rhetoric at the highest political levels they believe little has really changed [Anderson, 1990; Ophuls, 1990]. While there has been plenty of new resource management and environmental legislation around the world, and courses teaching such topics are relatively common, environmental degradation continues. In fact according to Young [1990], supported by evidence from the Worldwatch Institute [1994], things have become worse.

By the beginning of the 1980's, according to John Young [1990] in his most recent book *Post Environmentalism*, the environmental movement had run into the doldrums. This complacency was disrupted by a number of events in the late 1980's. The hot summer drought of 1988 in the northern hemisphere which killed stock, dried up grain-fields and fanned forest fires across the western states in America seemed to forewarn of impending global warming. This event coupled with reports of dead seals in the North Sea, an enlarged hole in the earth's protective ozone layer, a proliferation of waste being washed up on American beaches and the world wide journey of the freighter *Pelicano*, which had spent two years looking for somewhere to unload its cargo of toxic waste seemed to again warn the world of an impending environmental disaster [Young, 1990; Sale, 1993].

The emerging ***post-environmental***[18] movement has linked the lack of positive change to a number of things. Most believe the over-riding factors are that any

[18] The *post environmental* movement are a diverse and disparate "group' and include the *deep ecologists*), the *ecofeminists* and the *social ecologists*. Post-environmentalism is also known by other names such as radical ecology [Merchant, 1992], radical eco-philosophy [Zimmerman, 1993] and political ecology [Harris-Jones in Milton, 1993].

changes which have occurred have been in the context of 'sustainable growth' and a general reliance on the underlying assumptions of western science [Naess, 1989; Young, 1990] The recent changes have taken the form of simple reforms within current policies and institutional arrangements [Mazzotta and Kline, 1995]. The post-environmentalists advocate a departure from this approach and instead promote radical social changes and paradigm shifts [Mazzotta and Kline, 1995].

Despite the different reasons given for the "environmental crisis" there is, nevertheless, much common ground shared by deep ecology, social ecology and ecofeminism [Young, 1990]. Most post environmentalists believe that many of the environmental problems we face today can be traced to humankind's recent preoccupation with the domination of Nature[19]. Similarly they share a core vision and see that solutions to the "environmental crisis" may be found in the interconnectiveness of life, human values, ethics and spirituality [Bookchin, 1980; Naess, 1989; Mellor, 1992; Plumwood, 1993; Mazzotta and Kline, 1995]. They have built upon the ideas of people such as Leopold [1949] who recognised the need for an environmental ethic, Lovelock [1979] who personified, or rather re-personified, Earth with his Gaia hypothesis and Schumacher's [1973] appeal for a change in political and spiritual values. The ecofeminism movement was inspired by two important books, Griffin's *Women and Nature* in 1978 and Merchant's *The Death of Nature* in 1980 [Sale, 1993].

Berkes and Folke describe what they call 'The Ethics of Sustainability'. "*The way in which resources and the environment are managed depends on our values.*" "*The current Western world view of the environment has a complex background rooted in our religious, scientific, and industrial history*". "*The root of this aberration ... is our cultural emphasis on objectivity ... empiricism and scientism. It is too mechanistic and analytic; it is not sufficiently based on humanistic notions and morality toward nature*" [Berkes and Folke in Jansson *et al*, 1994, p144]. The

[19] In contrast, "*Environmentalism does not bring into question the underlying notion of the present society, that man* (sic) *must dominate nature; rather, it seeks to facilitate that domination by developing techniques for diminishing the hazards caused by domination. The very notion for domination is not called into question* [Bookchin, 1980 cited in Young 1990].

sentiments which are expressed here probably capture the essence of the post environmental challenge to the assumptions of the dominant ecology/ conservation paradigms. However, not surprisingly the post environmentalists have not escaped criticism themselves.

The eco-feminists generally believe that there are important connections between the domination, exploitation and fear of women and the domination, exploitation and fear of Nature [Young, 1990; Mellor, 1992; Sale, 1993; Martell, 1994; Mazzotta and Kline, 1995]. Both Nature and women are seen as having similar negative characteristics in religious and "scientific" myths and discourse; irrational, unpredictable, biological, mysterious and in need of control to name a few [Martell, 1994]. However, ecofeminists have been criticised of essentialism; that is they have argued that women, or at least feminine values, are more relevant to our relationship with Nature than masculine values. This has been construed by some to mean that, because of their reproductive functions and because both Nature and women have been dominated by men, women are 'closer to Nature' than men [Young, 1990]. This implies that they are better positioned to "solve" the worlds environmental problems because of their commonality with Nature. However, it appears that eco-feminists generally believe, though some do not, that feminine values are not biologically determined; that both men and women can exhibit both feminine and masculine values [Martell, 1994]. What they believe is that a "*greater generalisation of feminine traits and values among the entire population, female and male, can foster a more ecological society*" [Martell, 1994, p156]. The difficulty has been in identifying what feminine traits are when women often exhibit masculine traits and men feminine ones [Martell, 1994]

As with the ecofeminists the deep ecologists advocate a general rejection of economic growth and the underlying assumptions of reductionist science. Deep ecology was originally formulated by Norwegian philosopher Arne Naess to stand in contrast to what he termed "shallow environmentalism". Deep ecologists stress such things as "*ecological equality,* (which is) *the right of every species to existence and survival and with equal "intrinsic value" regardless of its importance for*

humans; the diversity and abundance of all life forms, which should not be reduced by humans except "to satisfy vital needs"; the sharp reduction of human population so that the other species may not only survive but have sufficient habitat to thrive; the preservation of wilderness as pristine habitat valuable in its own right; and the self realisation of humans through lower levels of consumption and resource use" [Sale, 1993, p63]. Both the deep ecology philosophy and movement have been criticised or, as described by Kirkpatrick Sale, 'savagely attacked' on a number of their standpoints. They have been labelled as sexist, anti-human, eco-fascist, and full of 'inconsistent rubbish' [Naess, 1989; Mellor, 1989]. Deep ecologists have been accused of ignoring social systems and their injustices, and failing to see the social and economic roots of the "environmental crisis" [Sale, 1993]. Their preoccupation with environmental philosophy and their lack of involvement at a political level has lead to accusations of being unrealistic and ineffectual. Arne Naess responds to the criticism by saying that deep ecology should not be seen as a doctrine or even a code of ethics, rather, it should be seen as a pool of ideas for practical work. Further, this sort of involvement should be seen as the first step to real long-term changes [Naess, 1989].

Murray Bookchin has been an ardent critic of deep ecology labelling it Malthusian, due to its stand on restrictions on human population numbers. He has also called it degrading, as reduces humans to a 'mere species' [Sale, 1993]. He has advocated a third type of post-environmentalist approach; that of *social ecology*. Social ecologists see the solution not in an uncritical embracing of Nature but in major social changes which eliminate hierarchial and class structures [Mellor, 1992; Mazzotta and Kline, 1995]. They believe that if society could eliminate such dominations as racism, sexism, homophobia and hierarchies such as class structures, capitalism, and the centralised state, our relationship with the planet would be resolved [Mellor, 1992; Sale, 1993; Mazzotta and Kline, 1995]. Their beliefs echo Marxism and strong criticism of social ecology has come from the same quarters [Plumwood, 1993]. Other post-environmentalists claim that by condemning all hierarchies social ecology presents a political system such as a centralised state based on representative democracy as the hierarchial equivalent

of racism, sexism or class exploitation. They sees that some political systems are socially and environmentally 'better' than others and, by condemning all hierarchies, social ecology leaves us with no means of deciding which is the worse and where to concentrate political change [Mellor, 1992].

3.4 Appropriate Technology

One of the things which makes us uniquely human is our use of technology within our relationship with Nature. In pre-modern times the side-effects of technology on the environment were relatively minimal and generally localised; with perhaps the obvious exception of areas of deforestation. With the onset of the industrial revolution many of the negative externalities created by technology increased greatly in size and had far-reaching consequences. With present day technology humans not only possess the ability to make species extinct and degrade ecosystems like never before but also the technology exists to annihilate us all and probably most species along with us. This is seen by many not as a result of the development of technology *per se* but in the growth in exploitative attitudes based on Western religion and Modernist science. Religion and science has not only not questioned man's domination over Nature but has actually actively encouraged it [White, 1967; Barbour, 1992].

As a response to this unquestioning of the logic of technology a counter-technology movement evolved led by figures such as Henry Thoreau [Kidd, 1992]. In *Walden* [1845] Thoreau highlighted some of the negative effects of technological industrialisation and called for a simplification of life [in Barbour, 1992]. Some took notice of his warning and more recently others have acknowledged that a major causal factor behind the environmental crisis is technology. However, for the most part there has been optimism about the ability of science and technology to provide solutions to environmental problems and at the same time continue to

raise standards of living. The so called ***technocentric***[20] perspective sees that solutions can be found in increasing amounts of science and technology, not less. The technocentrics perceive that any limits to increased growth are limitations imposed by the present state of technology and social organisation rather than any inherent limits within the environment or of resources to fulfil human needs [WECD, 1987]. Also while they may see that social, economic and political factors have something to offer in terms of "solving" environmental problems such problems are undoubtedly viewed as scientific and technical [Naess, 1989; Young, 1990]. The technocentrics do not presuppose that the environmental crisis will require changes in consciousness or the present economic system [Naess, 1989]. "*Present forests may be dying, but we can find or create new kinds of trees that thrive on acid rain, or we can find ways to live entirely without trees*" [Naess, 1989, p96].

In contrast, others do not share the optimism of the technocentrics. They believe that science and technology are the cause of the problems and are pessimistic about their ability to solve them [Naess, 1989; Young, 1990; Barbier, 1992; Daly and Cobb, 1994]. They take exception to the dominant high-energy, high-technology systems of production, agriculture and forestry [Kidd, 1992]. They believe that enduring solutions will not come from a technical base but from an ethical or moral base [Peet, 1992]. Like Thoreau, they are not generally anti-technology nor calling for the end of civilisation but instead they advocate appropriate technologies. It is not technology which is the problem but how we think about it and use it [Mellor, 1992]. The appropriate technology perspective not only describes technology but it is also the symbol for a heterogenous social movement associated with a diversity of ideas around the concept [Willoughby, 1990].

Appropriate technology was first popularised by Schumacher [1973] in his book *Small is beautiful: A Study of Economics as if People Mattered*. He characterised

[20] As characterised by Hays [1959] in O'Riordan [1981].

appropriate technology as "technology with a human face". He questioned technology and specialisation which dominated over Nature and called for technology which recognised a self-limiting principle in terms of size, speed and violence. Schumacher saw Nature as self-balancing, self-adjusting and self-cleansing and felt that technologies would be appropriate if they were also self-balancing, self-adjusting and self-cleansing. A number of other terms have arisen since this time such as alternative technology, intermediate technology and soft technology. Each of these terms reflects their authors' particular standpoint whether it be energy, development etc. There is considerable diversity amongst the meanings attached to them but invariably they stem from the ideas of Schumacher.

3.5 Sustainable development

Within the social dimension of sustainability the main focus has been on the notion of ***development***; that is the idea of economic, social and political progress for the betterment of humankind. 'Development Studies' evolved after World War II out of a concern for the plight of people in the under-developed and developing countries and a desire to have them "catch up" to the rest of the world. The emphasis was on fulfilling their basic needs such as clean water, and sufficient food, shelter and access to health care. In more recent times the development discourse has increasingly been concerned with the overdeveloped countries. This has been in response to such things as the deterioration of the environment and increases in poverty, pollution and the consumption disparity between the rich and the poor.

Up until the late 1960's development had almost exclusively focused on increasing material wealth. However, since this time studies of development in both the developing and overdeveloped world have begun to incorporate environmental, social and cultural values into their analyses. The idea that these values are an

inherent element of sustainability is advocated by a number of observers [Kidd, 1992]. They have also called for the recognition of the rights of women, indigenous people and non-human species. The new development paradigm has became to be known as ***sustainable development*** [Barbier, 1989]. It questions the idea of progress based primarily on material wealth and increasing levels of consumption (or growth). In earlier development models the emphasis was on raising standards of living in terms of material wealth. Within the more recent sustainable development paradigm the emphasis has shifted to improving the well being and quality of life of humankind [Mellor, 1992]. Environmental degradation has begun to be seen as a major impediment to economic development rather than an unfortunate but necessary byproduct of it [Munasinghe, 1993]. It was recognised that a deterioration in ones environment cannot be necessarily be compensated through increases in GNP per capita or through other 'economically rational' benefits. Those that have advocated sustainable development have also called for greater democracy through egalitarianism, and increased participation and consultation in decision making [eg Mellor, 1992]. The approach is often referred to as the 'bottom up' approach [Carley and Cristie, 1992; Simon, 1992]. The premise is that in order for society to develop further the people whose lives development seeks to change should be part of the decision making process. It is also supposed that people who are involved in decision making are, thus, more likely to carry such decisions through [Carley and Cristie, 1992].

More recently, however, sustainable development has come under increasing criticism [Simon, 1989; Rees, 1990; Dovers, 1993]. While it has been acknowledged that sustainable development is social and political in nature it is still seen as being fundamentally based on economic rather than social, ecological or cultural rationales. Further, the predominant concerns of sustainable development discourse, whether of the centrally planned or free market ilk, are with industrialisation (including agriculture and forestry), trade and urbanisation rather than a 'return to Nature' [Mikesell, 1992] or, indeed, even simply meeting the local needs of local people. Despite assertions of greater democracy, decentralisation of decision making to the community level and greater individual

responsibility towards the environment within sustainable development Young [1990] points out that the 'development' part of the paradigm virtually always results in inequality because of the part played in it by big government, big business and big bureaucracy. If the sustainable development models do not favour capital intensive forms of growth, as opposed to decentralised, diverse and labour-intensive forms of growth, they are judged to be inefficient [Young, 1990].

A reaction to this dominant sustainable development paradigm has been the evolution of the so called *ecodevelopment* perspective. Ecodevelopment was first proposed by Sachs in his 1977 thesis *The Salient Features of Development* [cited in Kidd, 1992]. This model was further refined by Riddell in [1981] and eleven points of action were advocated[21]. Ecodevelopment models are generally opposed to centralisation and giantism which appear to be a feature of contemporary industrial societies. They advocate principles of anti-hierarchy and decentralisation [Mellor, 1992]. Many of the points Riddell outlined have subsequently been incorporated, though probably more superficially than deeply, into recent sustainable development models. The first, that is to "establish an ideological commitment", however has generally been avoided [Naess, 1989]. This is possibly because, as is argued through this thesis, such an ideological commitment, if not requiring the total rejection of present Modernist ideologies, certainly requires their most critical examination. It is also supposed that any radical change in ideological commitment would be resisted through a perceived lack of practical solutions and an inherent resistance on the part of people for any more than small incremental and superficial changes.

One group of ecodevelopment thinkers who have proposed both ideological and practical changes which they claim are more than just superficial are the

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[21] The actions ~~which~~ Riddell advocated are; 1 Establish an ideological commitment. 2 Sharpen political and administrative integrity. 3 Attain international parity. 4 Alleviate poverty and hunger. 5 Eradicate disease and misery. 6 Reduce arms. 7 Move closer to self-sufficiency. 8 Clean up urban squalor. 9 Balance human numbers with resources. 10 Conserve resources. 11 Protect the environment.

bioregionalists[22]. *Bioregionalism* has its roots in San Francisco during the 1970's and as proposed by Kirkpatrick Sale is found through "*knowing the land, learning the lore, developing the potential and liberating the self*" [cited in Merchant, 1992, p220]. He argues that we must become 'dwellers in the land' and gain a greater knowledge of Nature by living in and accommodating to it, particularly to our immediate physical surroundings [Sale, 1974]. He believes that we should accept Natures physically demarcated territories or bioregions and live in decentralised communities within them. These bioregions would be defined by mountain ranges, water catchments, basins and the like and from them the inhabitants would ideally derive all their energy, food and shelter; enough to be self-sufficient.

The bioregionalists believe that this could be achieved through appropriate levels of organisation of social relations; self-reliancy, appropriateness in scale and decentralisation [Barbour, 1992; Martell, 1994]. Such an ideal would give individuals commitment to a particular place and its non-human as well as its human inhabitants and ensure sustainability [Plumwood, 1993]. It is also claimed by the bioregionalists that local production and self-sufficiency are both more environmentally sensitive and sustainable because they cut down on transport infrastructure that international and national trade requires and its consequences; for example, road building, fuel consumption and traffic pollution. Less concentrated communities lead to less concentrated problems such as sewage and environmentally damaging chemicals [Martell, 1994]. The bioregionalists see that the cities and megacities, which hold an increasing proportion of the worlds population, are 'inefficient' methods of organisation and therefore inherently unsustainable [Berg in Vandruss *et al*, 1990]. While they take the view that those who live and work in small-scale communities are likely to be closer to the environmental and social impacts they cause and, thus, more likely to feel their effects and respond in appropriate ways they also acknowledge that to turn the tide on rural-urban drift will be near impossible in the short-term. An alternative to turning the tide is to apply bioregional principles, such as decentralisation, to

[22]Bioregionalists are also sometimes called decentralists after an essential component of their philosophy [Barbour, 1992].

cities in the development of 'green' programmes [Berg in Vandruss *et al*, 1990].

Close-knit communities, where everyone knows one another foster community responsibility. Such communities need to be developed both in small towns and villages as well as large cities. In decentralised communities "(i)*ndividuals feel less atomised, anonymous and required to defend and assert their individuality through competitive individualism. In smaller communities relationships are deeper and less superficial*" [Martell, 1994, p53]. Decentralisation to a regional or local level is sometimes seen as an important means to increasing participation and democracy. "*Politically, decentralised communities are small and homogeneous enough for people to participate in decision-making and negotiate common agreements relatively harmoniously and unhindered by irresolvable differences*" [Martell, 1994, p54].

But as Carolyn Merchant [1992] highlights bioregionalism does have many critics. "*Focusing on the neighbourhood may preclude seeing the global context; emphasizing the native may obliterate the significance of the introduced, including humans. Ignoring the aqueducts that bring in water and the sewers that carry it away, the air systems that link ones city's wastes to another's illnesses, and the imported plants and animals from all parts of the globe oversimplifies the real-world life-equation*" [Merchant, 1992, p221]. Despite such criticism (and probably impracticalities) bioregionalism does appear to offer a philosophy and a process of change towards a more socially sustainable way of life. Barbour [1992] feels that an approach to increase the practicalities of a bioregional philosophy is a mix of small decentralised systems and large centralised systems. In the past he says "*we have subsidized large scale technologies*" so he suggests this be redressed with "*a deliberate effort to develop the untapped potential of smaller systems*" [Barbour, 1992, p137].

3.6 Intergenerational Sustainability

According to Charles Kidd [1992] a concern that the activities of present generation humans are degrading the Earth and its resources was first highlighted by Marsh in 1874. Marsh observed that the scale of change was no longer local but increasingly global. As early as this time it was becoming apparent that many environmental problems cross both regional and national boundaries and affect ecosystems and their inhabitants distant from their source. The effect that these changes may have on the ability of future generations to meet their own needs and the moral obligation of present generations to ensure an intact environment and adequate resources was later expressed by Shaler in 1905. Kidd [1992] called these concerns the *Biosphere Root* of sustainability. This root can be located in the social/ economic dimension of the model of sustainability (Figure 3). In 1987 the Bruntland Commission defined sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [WCED, 1987] focusing on this concern.

More recently Redclift and Sage [1994] stated that problems of resource allocation in time, between present and future generations, are central to the discourse surrounding sustainability. The concern is one of which has been termed ***intergenerational equity***. It is "*future orientated in that it seeks to ensure that the welfare of future generations at least equals that of current generations* [Turner *et al* in Jansson *et al*, 1994, p267]. It is essentially an ethical question of justice and morality in the 'efficient' allocation of resources among different generations [Randall, 1987]. It recognises that "*society cannot abdicate responsibility for the future impact of present decisions by leaving the problem to the mercy of private decisions based on current market signals*" [Perrings in Jansson *et al*, 1994]. As such, the subject of intergenerational equity is an attempt to bridge the gap between the social and economic dimensions of sustainability.

Intergenerational equity was first deemed a subject worthy of analysis within the

realm of neoclassical environmental economics. It served to challenge and extend neoclassical theory [Redclift and Sage, 1994]. Keeping the resource base intact[23] for future generations is today beginning to be accepted as a legitimate economic policy goal [Barbier, 1989]. The need to balance short-term conventional objectives of macro-economic performance with the more long-term considerations of future economic security and welfare has been acknowledged [Barbier, 1989]. Difficulties arise, however, as the valuation of resources within the neoclassical paradigm is based on the preferences of particular individuals living today. As such, sustainability using neoclassical economics is defined and evaluated using discounting procedures which necessarily lead to short time horizons [Costanza, 1991]. Discounted Cash Flow analysis (DCF) is said to contain inherent problems which undervalue or devalue the environment [Waring, 1988; Pearce *et al*, 1991; Gowdy and Olsen, 1994]. "*A dcf analysis through discounting, down plays the future impacts of any particular course of action, eg increased erosion caused by deforestation, or the fair intergenerational distribution of costs and benefits*" [Fraser in Hammond, 1995, p142]. Some have argued that because sustainability is a long-term and intrinsically worthwhile practice the use of a very low discount rate is justifiable [Wardle and Richardson cited in Cox, 1991; Markandya and Pearce; 1994]. Others believe that **if** a DCF is used to appraise a project at all a zero or negative discount rate should be employed [Gowdy and Olsen, 1994]. Some ecological economists have gone as far to say that the practice of discounting goes against the very notion of sustainability because of its preference for short-term over long-term gains. "(S)*ustainability implies a concern for the future, and this concern is necessarily reduced by discounting*" [Clark in Costanza, 1991, p325]. And yet others have suggested that discounting is an appropriate method but the circumstances in which it operates need to be changed[24].

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[23] It was realised that in physical terms it is clearly impossible to keep all non-renewable resources intact because any current extractions of such resources will reduce the stock for future generations. However, it was deemed possible to substitute over time renewable resources for non-renewables [Barbier, 1989].

[24] See for example Costanza's [1991] two-tier value theory approach.

The issue of intergenerational equity has not remained the investigative preserve of economics, however. Philosophers, theologians, environmental ethicists and other scientists have also offered insight, particularly ideas on how to incorporate intergenerational responsibility into contemporary society. It could be argued that the significance of continuity (an important facet of intergenerational equity) has been eroded with the reduction of the importance of both religion and history in peoples lives. The non-belief of an afterlife ties people more closely to the present and consideration of the past and for the future is reduced. However, John Young believes that it is still possible to maintain a concern for future generations. He feels that it is only those communities who are bound together by common experience which can really have and maintain such a concern. He has observed that "*a powerful ingredient of success in those societies which have established the most successful relationships with the environment is an emphasis on kinship, involving unbreakable bonds of obligation, specifically defined, to a large network of relatives, both living and dead. Kinship is thus a means of defining social functions and ensuring intergenerational and communal co-operation*" [Young, 1990, p36]. While he offers some insight he also acknowledges the difficulty for such bonds to develop in the context of a voluntary democratic society held together by intellectual ties alone.

Of late, the discourse surrounding the social-economic dimension has also begun to include the notion of ***intragenerational equity*** [Barbier, 1989; Young, 1990; Redclift, 1994]. The fair allocation of resources, is not only an issue between this and future generations but also concerns the fair distribution of resources between the current generation of humans and between humans and other species [Jansson *et al*, 1994]. Both Young and Redclift focus on the imbalances between the rich and the poor. Young believes that "*the livelihoods of the poor must be given priority for the time horizon of the poorer is shorter; the future value much less than the present*" [Young, 1990]. Redclift comments that "*the perspective of the poor is at variance with that of most economists and biologists, placing the immediate satisfaction of needs and the avoidance of risk before sustainability or higher productivity*" [Redclift, 1994, p35]. Before the problem of intergenerational equity

can be tackled these authors believe that intragenerational equity must be met[25].

While Barbier [1989] agrees with Young and Redclift on this point he sees the imbalances in equity between the developing and overdeveloped countries of the world. While people living within the overdeveloped countries have more or less been assured access to a relatively intact resource base "*it has not been kept intact through conserving resources but through extending consumption to include more and more of the global resource base. In the absence of conservation, the disproportionate consumption of world resources is the only means of guaranteeing an effectively intact resource base. Upon this foundation is built the alluring dream of material wealth that advanced countries have always offered their citizens*" [Barbier, 1989, p192].

3.7 Summary

This chapter highlighted that the concept of sustainability has many similar as well as many disparate, and possibly irreconcilable, interpretations. Each interpretation can be described as originating from a particular standpoint or view of Nature and humankind's place in the world. They have their own history, rationalities and legitimacy. Each interpretation can be traced back to one of six main roots of sustainability, as described by Charles Kidd in 1992. These roots were conveniently and logically able to be located in a reconceptualised model of Edward Barbier's 1987 model of sustainability; each root being directly related to a dimension of sustainability or a cross-over between dimensions (See Figure 3).

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[25] The placement of intergenerational and intragenerational equity in the model of sustainability was the most difficult of the concepts to locate. Intragenerational equity was a concern of Marx and his followers so it could be concluded that the idea of intragenerational preceded discourse on intergenerational equity. However Marx, like many of the other neoclassical theorists, did not include intergenerational issues into his thesis. In contrast the assumption in this model is that intragenerational equity also takes into cognizance intergenerational issues.

During the exercise of reconceptualising the sustainability model three identifiable paradigms (or waves of change) have became apparent within each of the dimensions (illustrated by the dotted lines in Figure 3). The spectrum of perspectives and standpoints ranges from those of *very weak sustainability* through to those of *very strong sustainability* [after Klassen and Opschoor, 1990]. The most recent paradigm contains perspectives which appear to be closer to a strong sustainability paradigm than perspectives from the former waves[26].

In the reconceptualised model these three paradigms have been positioned with the paradigm representing weak sustainability on the periphery of the model and the strong sustainability paradigm closer to the centre. Some of the main characteristics of each of the weak and strong sustainability paradigms which have emerged within the reconceptualisation of the model are listed in the below in Figure 5).

Very weak sustainability ----------> Very strong sustainability

Anthropocentric ----> Biocentric -----> Ecocentric
Conservative ----------> Radical
Economically rational ----------> Ethically and aesethically rational
Reductionist ----------> Holistic or eclectic
Separate ----------> Integrated
Objective ----------> Subjective
Masculine ----------> Feminine
Universal ----------> Regional --------> Local
Uniform ----------> Diverse
Positivism ----------> Normative
Hidden ideology ----------> Overtly ideological

Figure 5. A continuum of characteristics from a very weak sustainability paradigm to very strong sustainability paradigm.

[26] Essentially many of the ideas in the most recent paradigm remain just that, ideas, except perhaps with a small 'fringe' element actually putting these ideas into practice.

This classification of the characteristics of weak and strong sustainability is not an attempt to reject or subjugate weak sustainability or claim strong sustainability as the 'truth'. To reject weak sustainability outright would merely serve to elevate strong sustainability to a position which in turn would subjugate the weak. In practice these various sustainability characteristics are less clearly defined and overlapping anyway. There is rarely a clear dichotomy between the two. One gives meaning to the other but neither is more 'true' than the other. In the opinion of the author the strongest sustainability actually 'occurs' when there is a tension between the two but neither dominates; ie the dichotomy remains but the dualism disappears.

The reconceptualised model of sustainability is not an attempt to depict reality, because in reality the dimensions are entirely over lapping. It is unlikely that any of the dimensions exist outside the others (although it is argued in Chapter 4 that science often treats them as if they are separable). Rather, the model is an attempt to understand reality, or more correctly a number of realities.

As Barbier [1987] emphasised, sustainability is a dynamic and ongoing process. As such the concept is not bounded by time. The process is one of "*adaptive transformations*" and "*interactions*". All three dimensions are in a continual 'state' of flux. As one dimension changes the other dimensions similarly change and adapt to this change. The process is partly illustrated in the model by the arrows (see Figure 3). It is theorised that in an unsustainable state the fluctuations are substantial and the changes within the other dimensions are slow to react and adapt. A more sustainable process is composed of smaller fluctuations and more rapid and adaptive responses within the other dimensions. As such, sustainability is a reflexive process of adaptation and co-evolution rather than some illusive end state. Sustainability can, therefore, never be 'achieved' but it can be a desirable goal.

The strength of Barbier's [1987] model remains within the reconceptualisation; that sustainability is recognised as being based not on a single dimension but

many rationalities. Barbier recognised that to analyse sustainability in the context of a single dimension goes against the grain of what sustainability is about. The reconceptualised model explores these dimensions and processes on what is argued a deeper level than Barbier's original model of sustainability. Such a reconceptualisation not only serves to clarify the concept but it is argued should give it greater practical utility and analytical rigor. As such, it should provide a more useful conceptual framework for the analysis of natural resource problems and issues in relation to the concept of sustainability than the original model.

It is seen that the reconceptualised model could be usefully applied at both the macro (ie industry) and micro (ie individual unit) levels. Those within the industry and should be able locate their standpoint(s) within the model in terms of their own integrated economic, ecological and, social logic to carry out a self-critique. Analysts should also be able to use the model to do the same in order to determine the 'sustainability position' of the natural resource players. The process could be seen as a 'sustainability audit'. From the audit a programme of change could better be determined. The model should not only provide a history and legitimacy for various standpoints but such an audit should also provide a platform from which to challenge ones existing standpoint and provide direction or a programme for change in seeking ideas for 'improvement' in our transition to a more sustainable world.

Theory--the seeing of patterns, showing the forest as well as the trees--theory can be a dew that rises from the earth and collects in the rain cloud and returns to earth over and over. But if it doesn't smell of the earth, it isn't good for the earth.

Adrienne Rich
from *Notes Toward a Politics of Location*.

4.0 Postmodern Theory

4.1 Introduction

In the preceding chapter the concept of sustainability was explored through the reconceptualisation of a model of sustainability initially developed by Edward Barbier in 1987 [Barbier, 1987]. Through this process it become apparent that the three dimensions of sustainability he identified (economic, biophysical and social) and the construction and understanding of them are not universal. Within each of the dimensions and sub-dimensions, different paradigms of 'sustainability' were identified and located. The purpose of the previous chapter (Chapter 3) was to locate the many dimensions and waves of thinking of sustainability within a model to provide analysts and practitioners with an understanding of the complexity and alternatives within the concept. This chapter focuses more on providing direction within the model so that paths may be found in order to make progress towards a more sustainable world.

In this chapter it is argued that the 'sustainable solutions' which are being promoted in mainstream thinking[1] today are for the most part located on the periphery of the model and can be described as weakly sustainable [after Klassen and Opschoor, 1990; Turner *et al* in Jansson *et al*, 1994]. Other solutions appear

[1] Mainstream thinking is defined as the conventional wisdom which is generally accepted within the current economic growth paradigm at the educational, political and legislative levels.

to exist which are closer to the integrated shaded area of the model (and could be described as strongly sustainable), however, for the most part these ideas have not yet become part of mainstream thinking, let alone practice (see Figure 3). How can we move forward from the periphery of the sustainability model (a position of very weak sustainability) towards the centre? (a position of very strong sustainability).

Some theorists argue that science (as the dominant creator of knowledge) is based on a number of flawed assumptions which limit its potential for providing the direction which is required. Some even argue that the assumptions of science are not only flawed but are overtly anti-Nature or anti-human [eg Pepper, 1984; Harding, 1991; Mellor, 1992; Merchant, 1992; Plumwood, 1993]. This has obvious implications for those who believe that Modernist science will be able to provide us with sustainable solutions to our social, environmental and economic problems and deliver us from the 'environmental crisis'.

It is argued that in order to make the transition from a weak sustainability paradigm to a strong sustainability paradigm we have to critically question our construction of Nature and our place in it. A deconstruction of the underlying assumptions of the Modern scientific paradigm, particularly as it relates to forestry, will reveal why this paradigm has been labelled as weakly sustainable. Further, it is argued that only when the flaws and limitations of the Modernist (or weak sustainability) paradigm have been uncovered will it be possible for us to reconstruct science and move towards a Postmodern (or strongly sustainable) world.

As such, chapter 4 presents a challenge to the Modernist worldview. Michael Redclift [1994] argues that to continue to rely on the Modernist scientific way of thinking without questioning it will simply focus attention on mitigating the effects of the environmental crisis. To challenge the basis of Modernist science will enable one to look at the underlying causes of the environmental problems rather than their symptoms [Maser, 1994; Redclift in Redclift and Sage, 1994]. According to both Harding [1991] and Maser [1994] an inflexible insistence on the existing

assumptions of science and its worldview without questioning them will irrationally restrict wider thinking and our way forward.

The intention of this challenge is not to deconstruct[2] science for the sake of deconstruction. Nor is its purpose to subsume or dismiss the Modern scientific position from which the forestry discipline has evolved. Science need not be abandoned as has been suggested by some early Postmodern theorists [Griffin in Orr, 1992]. Rather its meaning needs to be expanded to include values and things that cannot be proved by science. The grounds for this is that the concept of sustainability is comprised of both non-scientific and scientific rationales, and if only those things which are deemed to be scientific are deemed to be legitimate are taken into cognizance it is unlikely that sustainability will be 'achieved'.

It is argued that such a deconstruction may appear to take a somewhat negative or pessimistic view towards forest science, however, the outcome of the deconstruction is intended to be positive, optimistic and constructive. To be constructive and offer alternatives to contemplate it is felt that one necessarily has to first be deconstructive. Deconstruction also necessitates one to generalise. The limitations of generalising are thus acknowledged from the beginning.

In 1993 the Indian ecofeminist Vandana Shiva wrote a book entitled *Monocultures of the Mind*. In the book she applied some of the revelations of her Postmodern contemporaries to 'scientific' forestry and agriculture in India[3]. She found that the set of assumptions which shape the worldview of Modern science also have implications for cultural and biological diversity in terms of agriculture and forestry. While the views held by Shiva are seen to be radical by the forestry

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[2] Deconstruction is defined as a strategy of critical analysis of language and texts which emphasises features exposing unquestioned assumptions and inconsistencies.

[3] While the relevance of Shiva's work in India in relation to New Zealand may be debated, given obvious differences such as climate, population, forests and the stage of 'development' of the two countries, it is argued that her findings are also relevant to the New Zealand situation. Both countries have a history of being colonised by Britain and having forestry roots in the Anglo-European tradition.

discipline she challenges, even in terms of the standpoint of the author, it is felt that her revelations shed some light on the 'sustainability problem' in relation to forestry.

An American forest ecologist, Chris Maser who worked for 13 years for the US Bureau of Land Management, also holds what his former employers termed radical views, particularly on the protection of biodiversity, and has written a number of what some term 'controversial' articles. He sees that the human tendency to reduce the diversity of the forest, to work toward the most cost-efficient, least complicated operation, works against forestry's long-term interests [Wray, 1988]. His work to date has culminated with the publishing of a book in 1994 entitled *Sustainable Forestry*.

This chapter draws heavily on the work and experiences of both Shiva and Maser. They are amongst the few people whose work appears to the author to sufficiently challenge the Modernist view which holds onto what Klassen and Opschoor [1990] would call a very weak sustainability paradigm. Their arguments demonstrate why it will be difficult, if not impossible, to 'achieve' so-called very strong sustainability in indigenous forestry under the present dominant paradigm. It is deduced that a reconstruction of forestry based on a 'Postmodern science' is seen as the best, or even the only way, of moving from a very weak sustainability paradigm to one of stronger sustainability. This is not to suggest that Maser and Shiva's interpretations are the 'truth' but their 'truths' are one amongst many and should be listened to.

4.2 Postmodernism and Sustainability

The spread of 'Postmodernism' in recent years has been pervasive. Today there is hardly an area of intellectual endeavour which has escaped its influence, both in the academic and popular spheres of life [Docherty, 1993]. The term was first popularised in the areas of art and architecture in New York during the 1960's.

Since this time Postmodern theory has been used to challenge and expand the meaning of virtually every cultural discipline including history, law, language, literature, politics, philosophy and the arts and sciences in general including geography, medicine and biology.

The term 'post-modern' first appeared in 1939 in the fifth volume of Arnold Toynbee's massive *A study of History* [Docherty, 1993]. He used the term to depict an historical period, to distinguish it from other periods such as the Modern, avant-garde, pre-modern and archaic. At first he placed the end of Modernity and the beginning of Postmodernity somewhere between 1850 and 1875. Later he revised this to the period between the world wars, 1918 - 1939. Other commentators have since revised the date. Postmodernity has 'travelled' through the 1950's and 1960's and today the generally agreed break between Postmodernity and Modernity has settled at around 1968 [Docherty, 1993]. It is suspected that some time in the future this date will once again be revised as it can scarcely be said that we have actually entered a Postmodern age. Some even describe Postmodernism as an historical period in a utopian future; a better time which has yet to come [Jameson, 1991]. In fact, the separation between Modernism and Postmodernism is difficult, if not impossible, to make as they are not separated by a distinct boundary [Hassan in Doherty, 1993].

But Postmodernism is more than ~~sim~~ply, a hard to pin-down, period of history. While Doherty [1993] argues that it is a pointless and futile exercise to actually try to find a simple definition for Postmodernism, David Griffin loosely describes it as a reaction against the Modern; "*a growing dissatisfaction with modernity and an increasing sense that the modern age not only had a beginning but can have an end as well*" [Griffin in Orr, 1992, *ix*]. While Postmodernism is not inherently anti-Modern, as one may be led to believe, it certainly is about recognising the limitations of Modernity and questioning and rethinking what it has to offer.

Postmodernism is difficult to define because its ideas are too heterogenous to form a clear-cut movement or school of thought. Griffin has commented that

"*postmodernism refers to a diffuse sentiment rather than any common set of doctrines*" [cited in Orr, 1992, px]. Ihab Hassan poetically stated that the ideas of Postmodernism "*evoke a number of related cultural tendencies, a constellation of values, a repertoire of procedures and attitudes*" [cited in Doherty, 1993, p147].

Griffin identified two distinct positions within Postmodernism. One he calls *deconstructive postmodernism*[4] which was inspired by French thinkers such as Ludwig Wittgenstein, Martin Heidegger, and Jacques Derrida. Deconstructive Postmodernism "*overcomes the modern worldview through an anti-worldview: it deconstructs or eliminates the ingredients necessary for a worldview, such as God, self, purpose, meaning, a real world and truth as correspondence*" [cited in Orr, 1992, px]. Such a standpoint has resulted in accusations of relativism, nihilism[5] and even anarchism. It is often seen as radical, anti-science and anti-establishment [Griffin in Orr, 1992; Hassan in Doherty, 1993; Soulé and Lease, 1995]. This probably accounts for its negative, anti-Modernist image and a general perception that it is both impractical and directionless.

However, deconstructive Postmodernism does not claim that there is no reality, which is often the basis for these accusations, but it does claim that no single conceptual definition of reality can be made. It challenges science as the supreme and only creator of reality; ie the notion that only things that can be proved by science using scientific method can be truths. They argue that many and varied narratives can be told and need to be listened to; science is only one narrative amongst many [Morrison, *pers comm*]. Some Postmodern theorists (ie Heidegger) see the basis of reality and truth as ethical. They see that knowledge is real if it is ethical; ie if it relates to respect and caring. Yet to other theorists if knowledge is useful, ie that the many and varied narratives are listened to (given that these narratives necessarily change over time and that they may be legitimate in some contexts while ceasing to be in other contexts), then usefulness becomes the

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[4] *Deconstructive postmodernism* is also called *early-postmodernism* and *eliminative postmodernism*.

[5] Nihilism is doctrine which rejects all religious and moral principles.

criterion for truth and reality [Morrison, *pers comm*].

Deconstructive Postmodernism led on to what is seen as a pragmatic form of Postmodernism, that of *reconstructive postmodernism*[6]. Reconstructive postmodernism "*seeks to overcome the modern worldview not by eliminating the possibility of world views as such, but by constructing a postmodern worldview through a revision of modern premises and traditional concepts*" [Griffin in Orr, 1992, px]. It points out the need to always reconstruct from many dimensions and perspectives. Reconstructive Postmodernism aims to be reflexive, self-questioning and, as such, able to adapt depending on changing circumstances. Deconstructive Postmodernism takes exception to the way science has constructed the dominant worldview. Constructive Postmodernism does not reject science as such but rather questions the legitimacy of the modern sciences which only permit a worldview based on their own assumptions and data [Griffin in Orr, 1992]. Reconstructive Postmodernism does not demand a reversion to the Pre-modern, reject all reason and embrace irrationality as is often claimed by its critics, but calls for a wider meaning of science which is less hierarchical and oppositional and more contextual and reflexive, as well as drawing upon a greater source of rationalities [Plumwood, 1993][7].

Recently, Postmodernism has begun to be used in relation to the concept of sustainability [Orr, 1992; Redclift and Sage, 1994]. This is not surprising as a number of the ideas surrounding both Postmodernism and sustainability appear to be shared. What is surprising is the small amount of literature which has been written considering the obvious connections between the two. Redclift [in Redclift and Sage, 1994] supported the idea, brought out in the reconceptualisation of the model (in Chapter 3), that sustainability is neither a inherently Modernist or Postmodernist concept. However, Redclift argues that so-called 'weak sustainability' has its roots in Modernist thinking and 'strong sustainability' in

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[6] *Reconstructive postmodernism* is also called *constructive postmodernism, revisionary postmodernism*, *late-postmodernism* and *post-postmodernism*.

[7] This thesis has been written from such a constructive (or reconstructive) standpoint.

Postmodernism. "*Married to the idea of "development", sustainability represents the high-water mark of the modernist tradition. At the same time, the emphasis on cultural diversity, which some writers view as the underpinning of sustainability, is a clear expression of postmodernism*". [Redclift in Redclift and Sage, 1994, p17].

While Postmodernism has its roots in art and architecture the social sciences were quick to adopt the theory. The natural sciences, in contrast, have been slower to make use of Postmodernism. While the discipline of forestry has been subject to recent discourse in relation to Postmodernism only a single article could be located which made a direct connection between the two[8]. Wikstrom of the USDA Forest Service called for a new way of thinking about forestry. In his paper, entitled *Moving into the Post-Modern World*, he cited examples of changes which were beginning to take place within the discipline which he felt signalled a paradigm shift from the Modern to the Postmodern [Wikstrom, 1987]. While Wikstrom did not use the term 'sustainability' in his paper, the very strong sustainability paradigm described in the preceding chapter of this thesis displays many of the characteristics of the 'Post-Modern' world which he envisaged. Conversely the very weak sustainability paradigm can be equated to a characterisation of a Modernist view of the world.

4.3 Critique of Science[9]

Knowledge of and meaning within Nature are not inherent. Our understanding of Nature and our place in Nature is interpreted through a world view advanced

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[8] Other forestry articles were located by the author but often they did not make explicit reference to the use of Postmodernism.

[9] This section draws on the work of a number of mainly Postmodern commentators who have carried out previous critiques of science, or sometimes called critiques of reason or critiques of progress. While Postmodernist thinkers have not been the only ones to carry out such critiques the others invariably call for better application of the existing assumptions of science while postmodernists call for a questioning of these assumptions.

predominantly by Modernist scientific traditions including observationism, rationality, objectivity and universalism [Pepper, 1984; Harding, 1991; Mellor, 1992; Merchant, 1992; Plumwood, 1993]. While these assumptions and type of thinking have helped science provide us with much of the technology and prosperity we know and enjoy today this has in turn also produced many of the economic, environmental and social problems we also face [Pepper, 1984; Mellor, 1992; Merchant, 1992]. Some feel that these problems are scientific problems and, thus, can be solved through better application of scientific methods [Mellor, 1992].

Others, in contrast, consider that the methods and assumptions of Modern science, have been causal factors in many of these problems, and is therefore impotent to solve them [Pepper, 1984; Mellor, 1992; Merchant, 1992; Plumwood, 1993]. They argue that the construction of reality by Modernist science is in direct conflict with a fuller understanding and realisation of 'strong sustainability'. In their view, the supremacy of science as both a method of seeking knowledge and the legitimate creator of reality is based on a number of flawed assumptions and one dimensional thinking [Harding, 1991; Shiva, 1993]. They have found that the methods and assumptions of Modern science are lacking in a rationality which has valid meaning for sustainability. Lynn White Jr [1967] probably best sums up their collective opinion when he said that "(m)*ore science and more technology are not going to get us out of the present ecologic crisis until we find a new religion* (world view)*, or rethink an old one*" [White, 1967, p1206]. They claim that it makes it difficult, if not impossible, to attain a greater understanding of both our predicament and 'sustainable solutions' through the present scientific world view. This is because sustainability not only comprises realities and 'truths' which can proved (or disproved) by science but it is also comprised of realities which cannot be proved (or disproved) using scientific methodologies. Sustainability is also about beliefs and values which make individuals and societies reality. These are not explicitly part of the scientific method. It is argued by some that this is the main reason why we are in the present predicament [Pepper, 1984; Mellor, 1992; Merchant, 1992; Plumwood, 1993].

Science is concerned with the production of knowledge. In the *Oxford Dictionary* science is defined as "*branch of knowledge involving systematized observation of and experiment with phenomena; systematic and formulated knowledge*" [Thompson, 1993]. This suggests that there are other branches, or forms, of knowledge. Indeed, it is a reasonable assumption to make as things were discovered and knowledge was created before the presence of science and its methods. It is also reasonable to assume that alterative forms of discovery and the creation of reality and knowledge still persist beyond the folds of science.

In the Modern worldview, however, the only reality which is seen to be legitimate, according to Pepper [1984], Hargrove [1989], Harding [1991] and Plumwood [1993] is that which recognises 'facts', is objective and empirically verifiable through observation and measurement. Ethical, aesethic and religious views are deemed meaningless because they are not scientifically verifiable [Hargrove, 1989]. This is enshrined in the philosophy of science termed *positivism*. Such science is also described as reductionist science, empirical science or mechanistic science denoting three of its main features, or simply Western science denoting its point of origin. It has also been called Enlightenment[10] science or Galilean-Cartesian-Baconian-Newtonian science [Griffin in Orr, 1992] in reference to its seventeenth century architects. In this thesis it is referred to as Modernist or Modern science so as to be inclusive of its characteristics, its origins and its architects.

4.4 Objective Worldview

The established practice of Modern science has been for the observer to take an objective view when studying a subject, performing an experiment or designing a model. The observer seeks to be and is regarded as apolitical and value-neutral. The observer creates a clear method, then observations of nature or natural

[10] The age of Enlightenment is also called the age of reason being characterised by reductionism, rationality based on empirical data and analytical thought.

phenomena (including humans) as isolated objects are made, empirical measurements are taken, data is collected and conclusions are reached. Facts, knowledge and pictures of reality are created out of verification and falsification. The method of inquiry is deemed to be rational and objective as are the outcomes. Science gains much of its 'supreme legitimacy' from this claim of objectivity and 'value neutrality' [Pepper, 1984; Redclift in Redclift and Sage, 1994]. The deconstructive Postmodernists reject this absolute metaphysical claim about what comprises reality and 'truth'.

According to Harding [1986] "(n)*either God nor tradition is privileged with the same credibility as scientific rationality in modern cultures*" [cited in Shiva, 1993]. Merchant [1980, 1992], Harding [1991], Plumwood [1993], Shiva [1993] and others, particularly feminist, thinkers have challenged and called into question the existence of objectivity and through this inquiry have also challenged science's right of claim to a 'supreme legitimacy'. They believe that no person can be absolutely objective. We all have inherent biases, prejudges and assumptions which shape our view of the world and which we cannot leave behind. Observers of Nature and their activities do not exist in a value-free vacuum. The observer in the process of observation unavoidably influences the observed and its outcomes [Hubbard in Gergen, 1988; Maser, 1994]. "*Reality is never simply the objective datum, the concrete fact, but it is also peoples perception of it*" [Freire, 1985, p51].

Pepper [1984] supports the conclusion that all knowledge is socially constructed and subjective, commenting that two individuals or groups carrying out identical research using conventional scientific method may reach quite different conclusions. If science is objective, as is claimed, scientific knowledge should always produce an undisputable consensus. However, it appears that science and scientists name, describe and structure reality from their own experiences and motivations. "*Scientists are in fact seldom disinterested or devoted to the truth alone; like other people, they often seek professional recognition, personal success, and higher pay*" [Barbour, 1992, p28]. This is only occasionally acknowledged, however. Science which is absolutely objective, apolitical and value-neutral is thus

a pretence and objectivity is an 'untruth'. Maser [1994] also supports this conclusion. He claims that there is no absolute truth. "*The insistence in science to neutralise human subjectivity is an attempt to objectify Nature and thereby to deny participation with Nature in any form, which is impossible. Nevertheless, the attempt to objectify Nature makes scientific theories and facts no more than social constructs*" [Maser, 1994, p82].

Kumar [1995] brings into question the status of science as the 'only true method of inquiry' and Harding [1991] describes it as an élite activity and a privileged method of understanding. Pepper [1984] agrees with them. "*Far from being simply a source of objective facts about ourselves in the natural world, we find that science is a social activity, and that it may be ideologically based - that is, it is associated with sets of ideas propagated to serve the interests of particular groups in society*" [Pepper, 1984, p147]. Reality is invariably created by and for the white, middle class, male culture in Western society [Harding, 1991]. This small intellectual élite working within spheres of knowledge which are closely allied to new technologies and wasteful resource uses has a vested interest in the maintenance of the *status quo* and the continuation of the notions of value neutrality and "objective" science [Plumwood, 1993; Daly and Cobb, 1994; Redclift in Redclift and Sage, 1994]. "*Science is made, by and large, by a self-perpetuating, self-reflexive group: by the chosen for the chosen*" [Hubbard in Gergen, 1988, p3]. "*As long as the disciplines discourage any interest in values on the part of the practitioners, they inevitably discourage the ordering of study to the solution of human problems*" [Daly and Cobb, 1994, p131]. The acknowledgement that science is not objective through the recognition of the indisputable unity between the object and subject helps to liberate one to new ways of thinking, provokes one to dig deeper and ask different sorts of questions including those of concerning human values and ethics.

4.5 The Creation of Knowledge

The Modernist project according to Jürgen Habermas has not only foundered because of the absolute domination of 'objective science' under capitalism but also because it has marginalised all other modes of cognition [in Bertens, 1995]. Empirical knowledge is deemed to be the only type of knowledge which is valid; that is knowledge which is based on evidence of the senses through observation and experiment [Pepper, 1984]. Other forms of knowledge, such as intuitive, or emotionally- or spiritually-derived knowledge or knowledge gained from life experience (through adaptation around changing contexts) are not just simply assigned a lower status but often their existence is totally negated; they are made invisible or extinguished [Plumwood, 1993; Shiva, 1993]. If such 'wild knowledge'[11] is actually recognised it is deemed to be inferior to scientific knowledge and actively suppressed. Vandana Shiva feels that "(t)*he prefix 'scientific' for the modern systems, and 'unscientific' for the traditional knowledge systems has, however, less to do with knowledge and more to do with power*" [Shiva, 1993, p10]. Naess [1989] simply sees that the predominant Modernist ideology has a general distaste for local traditions and cultural diversity.

In Shiva's experience in India those involved in 'scientific forestry' have been trained to see forests only in terms of commercially valuable and 'merchantable' timbers. Forests are deemed to be productive or unproductive on the basis of the timber market not necessarily in terms of their total biomass or the range of products which can be utilised from them [Shiva, 1993]. An important biomass output of trees that is never assessed by foresters, according to Shiva, is the yield of seeds and fruits. Likewise, the bark, roots, branches and leaves of trees are seldom taken into account within a forest inventory despite products as diverse

[11] These other forms of knowledge have been labelled by various commentators as alternative knowledge, local knowledge, indigenous knowledge, traditional knowledge or traditional ecological knowledge depending on their context. Will Wright [1992] coined the term 'wild knowledge' which is the term favoured for 'non-scientific' knowledge in this thesis. Wild knowledge is favoured in order to encompass knowledge which is pre-modern in origin but also recognises that these and other ways of creating knowledge continue in contemporary society today.

as food, medicines and firewood being derived from these forest products by local people. She sees that such one dimensional thinking "*discounts the value of local knowledge and declares locally useful plants to be weeds. Since dominant knowledge is created from the perspective of increasing commercial output, and responds only to values on the market, it cannot see the values assigned to plant diversity by local perceptions*" [Shiva, 1993, p27].

Most wild knowledge systems are based on the life-support capabilities of the forest, not on the commercial value of timber [Shiva, 1993]. In Modern forestry logic these 'other' species are not valued unless they can be commercialised. If they can be commercialised they are given the status of 'minor products'; with timber and wood being treated as the 'major products'. If they cannot be commercialised they are made to disappear by denying them the status of legitimate knowledge and assigning them the adjectives 'primitive' and 'unscientific' [Shiva, 1993]. Thus entire spaces in which wild knowledge exists are being marginalised and lost. "*The diverse knowledge systems which have evolved with the diverse uses of the forest for food and agriculture* (have been) *eclipsed with the introduction of 'scientific' forestry, which treats the forest only as a source of industrial and commercial timber. The linkages between forests and agriculture,* (have been) *broken and the function of the forest as a source of food* (is) *no longer perceived*" [Shiva, 1993, p17].

Wild knowledge is often suppressed by Modernist science on the grounds that it is subjective, contextual and socially constructed and, therefore, lacks validity [Harding, 1991; Shiva, 1993]. However, some proponents of Postmodernism argue that such a dualism between the subjective and objective exists only in the minds of those that are part of the Modernist project. They view objectivity as a scientific construct which was created to serve its own purposes. Science is based on a set of values and beliefs as are other forms of understanding. On this basis they believe that Modernist science is just as subjective as any other form of knowledge system and has no greater claim to supreme knowledge [Harding, 1991; Shiva, 1993; Redclift, 1994]. It could also be claimed that Modernist science has less of

a right to legitimacy because it tends to dominate over and actively marginalises and undermines wild knowledge and other rationalities without moral reprieve [after, Plumwood, 1994].

4.6 Reductionist Worldview

Modernist science has typically been concerned with the parts of a system rather than the whole; looking at the parts under more and more powerful microscopes in order to reduce the system into smaller units of verifiable knowledge [Mellor, 1992]. Hubbard writes that "(n)*atural scientists attain their objectivity by looking upon nature and natural phenomena (including other people) as isolated objects*" [Hubbard in Gergen, 1988, p10]. *'Reductionist'* science is based on the assumption that through analysis everything can be reduced to the same basic quantities and qualities, all of which are measurable and expressed in terms of universally applicable principles [Pepper, 1984]. In the reductionist scientific view according to Hales [1982] everything is reducible to seven physical qualities (length, mass, time, etc). "*These plus the ten base digits 0-9 ... are the sum total of the legitimate language of observation in hard physical science, and the stuff of all explanation*" [Hales, 1982, p124-5 cited in Pepper, 1984, p50].

Such a reductionist approach focuses only in the part under investigation; the assumption being that the whole is equal to the sum of its parts. It "*is based on the resolution of phenomena into isolatable causal trains and the search for basic 'atomic' units or parts of the system. Classical science depends on weak or non-existent interactions between parts and essentially linear relations among the parts, so that the parts can be added together to give the behaviour of the whole*" [Costanza in Barbier, 1993; p29]. Interconnections between the parts and those parts which cannot be observed and quantified are deemed not to exist within reductionist thinking.

Postmodern theorists argue that the whole is actually greater than the sum of the

parts and that the interconnections between the parts are as important as the parts themselves. The Norwegian philosopher Naess [1989] argues that the parts of the whole cease to be the same things without the interconnections. Pepper "*draws an analogy between complex systems and living organisms, where to examine separately or remove one part from the organism makes that part (and perhaps the whole system) meaningless* [Pepper, 1984, p238]. The deconstructive Postmodernists also argue that the whole can not be defined; it can only be intuited and respected [Morrison, *pers comm*]. Acknowledging the interconnectiveness and interdependence of the parts is especially important for a deeper understanding of such complex systems inherent in Nature [cited in Zimmerman, 1993]. According to Chris Maser [1994] the essential ingredient of sustainability is the acknowledgement that 'the whole is greater than the sum of its parts'. This expression encapsulates what is meant by the term holism; holism being the opposite of reductionism [Pepper, 1984].

The Modernist or scientific management of forests for utilisation generally has a *primary objective* of maximising short-term economic profits focused on *one or two species* [Maser, 1994]. In Shiva's experience the implementation of 'scientific forestry' has "*reduced the value of diversity of life in the forest to the value of a few commercially valuable species, and further reduced the value of these species to the value of their dead product - wood*" [Shiva, 1993, p18]. Further, the "(f)*orest as an ever-evolving living organism is discounted as having no intrinsic economic or ecological value over the longrun. The focus on the economics of trees is so narrow that we lose sight of the forest* [Maser, 1994, p87].

Roy Ellen [1993] agrees with Shiva and Maser based on his experience in Indonesia. "*In contrast to former patterns of timber extraction,* (by local people) *typified by a gradual denudation of primary forest and the selective (but not exhaustive) extraction of a variety of species to cater for a wide range of essentially*

local uses[12]*, modern methods* (by international forestry companies) *involve either the selective extraction of just a few species to exhaustion, or the total destruction of forest in a short period to cater for a narrow range of non-local uses.*" [Ellen in Milton, 1993, p133].

Shiva argues that "*scientific management of* (both plantation and natural) *forests has a clear anti-nature bias, and a bias for industrial and commercial objectives*" [Shiva, 1993, p22]. While the FAO does not express it quite so strongly they do observe that the forestry discipline's conceptualisation of sustainability does have a narrow focus on maintaining tree populations rather than forests as biological communities. "*Management of the forest to provide a sustained yield of timber is still what many foresters have in mind when they talk of sustainable forest management. This definition focuses on the production of wood and does not address the wider issues of the ecological and social functions of forests, with which timber production may only incidentally be compatible or may even conflict*" [FAO, 1993, p10]. Chris Maser is more sceptical. He claims the notion of sustainable forest management, as it is practised to date in the Pacific Northwest, equates to sustained cut. He says that the so-called 'sustained yield' has come from the old-growth[13] forest which is not being sustained but diminished. Further the predominant practice of sustainable yield forestry excludes all other human and ecological intrinsic values except the production of fast-grown wood fibre [Maser, 1994].

Moreover, the plant and animal species which are not directly concerned with wood production to meet commercial, particularly industrial, needs are viewed as 'weeds', 'waste' and 'pests' [Shiva, 1993; Maser, 1994]. Like the wild knowledge associated with these plants and animals they are marginalised. J Bethel, an

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[12] Out of a total of 272 forest trees named by the local Nuaulu people 78% (or 212 species) have a particular human use.

[13] Old-growth forest has three prominent characteristics according to Chris Maser [1994]: large live trees, large standing dead trees and large fallen trees. Old-growth forest is often called 'over mature' forest by foresters.

international forestry expert, acknowledges that the biomass of natural forests is generally large, in reference to the tropical forests, however, he sees that the overall productivity of a natural forest is relatively unimportant [cited in Shiva, 1993]. In reductionist Modern forestry productivity is measured in terms of industrial and commercial biomass alone. However, for many people who live and work in forests around the world they are more than an industrial 'timber mine'; they are a whole. The forests and the 'weeds', 'wastes' and 'pests' contained within them are also a source of food, medicines, building products and spirituality. When these things are denied or separated out from the forest they are lost along with the multi-dimensional and diverse knowledge systems of forest dwellers and forest users [Caufield, 1985; Shiva, 1993]. Such a loss appears to represent a directional movement within the reconceptualised model of sustainability from the centre towards the periphery.

4.6.1 Specialisation

Adam Smith maintained that prosperity was dependent on specialisation as specialisation made workers more productive and the system more efficient [in Daly and Cobb 1994]. However, Shiva [1993] sees that 'productivity' and 'efficiency' have generally been defined in terms of a single commercial objective rather than in terms of social or biophysical efficiencies with multiple objectives. Reductionist thinking within the Modern worldview has created the expert and the specialist. It has enabled us to overcome technical problems and given us many of the consumer products we enjoy today. While Mellor [1992] agrees that such an approach has definitely achieved results she also argues that it has generally not created enduring solutions. She considers that single-path one-dimensional thinking as a result of specialisation has failed to comprehend the whole and the interconnectiveness between the parts of Nature. This is because analysing complex systems as separate parts without relating these parts to the whole, according to proponents of holism, "*makes that part (and perhaps the whole system) meaningless*" [Pepper, 1984, p238]. Further the, Postmodernists also argue

that the whole cannot even be defined [Morrison, *pers comm*].

Wikstrom [1987] supports this view of specialisation. He sees that the forestry industry in North America has become increasingly specialised in its drive for 'efficiency'. "*Just as modern science developed under the assumption that nature was a closed system that could be segmented studied independently, foresters tended to specialize, in the process loosing the perception of the whole*" [Wikstrom, 1987]. While specialisation may lead to higher short-term profit margins, the connection between the parts of the whole system, including other workers and their roles, becomes lost. New Right philosophies, which have become popular in New Zealand over the last ten years, prize economic rationality above all other rationalities. They have perpetuated the specialist mentality in the form of the forestry contract worker. With specialisation the contract logger is financially encouraged to be indifferent to the aesthetics or the side effects of what s/he does. The main concern is to fell trees as quickly as possible and get them to the skid site, despite environmental conditions in their contract to the contrary. Anything less will affect themselves negatively in a financial way [Topping, *pers comm*].

Daly and Cobb argue that specialisation *per se* is not a bad thing in itself. "*The point is rather that the disciplinary organization of knowledge is not the best way to specialise... The adage about knowing more and more about less and less is built into the* (present) *disciplinary organization of knowledge*" [Daly and Cobb, 1994, p132]. Problems occur when the specialists and experts do not understand or attempt to understand the whole and operate as if their area of study or work operates outside of a social context while clinging to the idea of value neutrality. Redclift claims that science has been for the most part concerned about a narrow focus on the accumulation of industrial and human capital. "*Wherever we look - nuclear power, toxic wastes, pesticides, air pollution, water quality - we see examples of our failure to grasp the social implications of the scientific knowledge we possess and the costs which are passed onto the environment*" [Redclift in Redclift and Sage, 1994, p31].

An example in forestry of this type of this reductionist thinking and specialisation which has recently gained the attention of the New Zealand public has been in the area of timber treatment [Kopp, 1991; Szabo, 1993]. Pentachlorophenol (PCP) and copper chrome arsenic (CCA) are two chemicals used to treat timber for sapstain, in the first instance, and to increase durability, in the second. Their persistent toxicity, which is the desirable trait for which they have been developed, is now proving to be a highly undesirable trait in the context of human health and the environment [Szabo, 1993; Horton, 1995]. Alternative solutions to this problem continue to be reductionist in thinking. Research into finding chemicals which are 'less' of an environmental hazard and 'safer' methods to treat timber predominate. Under the Modern reductionist paradigm the 'wrong' questions are often asked. Maser [1994] puts this phenomena down to the preponderance of Modern science to ask 'method- orientated' questions, rather than 'problem-orientated' questions. Under this paradigm questions such as 'should we continue to produce such chemicals containing traits of persistent toxicity considering their unknown long term environmental effects and their reliance on non-renewable petroleum products?', or 'Should we be growing trees which are particularly susceptible to sapstain or decay?', or 'Is sapstain a problem of timber or is it a problem of the mind?' are unlikely to be asked. "*We believe that through method-orientated experiments we can learn the truth about Nature, when in fact we are learning only about our methods, which are our experimental designs, assumptions, and expectations about the outcome*" [Maser, 1994, p82].

4.6.2 Monocultures

The Modern reductionist paradigm as well reducing the objectives of forestry to a primary economic objective also serves to reduce the biological diversity of the forest [Shiva, 1993; Maser, 1994]. The ultimate reduction is to a single species of a single genotype; the *monoculture*. Vandana Shiva sees the main risk to both cultural and biological diversity is the practice of thinking in term of monocultures or what she terms 'monocultures of the mind'. She sees uniformity and diversity

not just patterns of landuse but as ways of living and thinking. "*Monocultures first inhibit the mind and then transfer to the ground*" [Shiva, 1993 p7]. "(M)*onocultures of the mind make diversity disappear from perception, and consequently from the world. The disappearance of diversity is a disappearance of alternatives and gives rise to the "there is no alternative" syndrome. Alternatives exist but are excluded*" [Shiva, 1993 p5]. She argues that "*Dominant scientific knowledge ... breeds a monoculture of the mind by making space for local alternatives disappear, very much like monocultures of introduced plant varieties leading to the displacement and destruction of local diversity*" [Shiva, 1993, p12]. The monoculture of the mind sees the natural forest and non-merchantable species simply as weeds, if they are seen at all.

Shiva sees that natural forests are life support systems for plants, animals and people, and should be protected and regenerated for their biospheric functions. She sees that they should be conserved for their use by local people for local needs. However, from her experience in India, "(t)*he reductionism of the scientific forestry paradigm created by commercial forest interests violates both the integrity of the forests and the integrity of forest cultures who need the forests in its diversity to satisfy their needs for food, fibre and shelter*" [Shiva, 1993, p18]. While environmental and social 'aspects' may be 'taken into consideration' she sees that "'*scientific forestry' in its present form is a reductionist system of knowledge which ignores the complex relationships within the forest community and between plant life and other resources like soil and water. Its pattern of resource utilisation is based on increasing 'productivity' on these reductionist foundations*" [Shiva, 1993, p21].

Scientific forestry constructs the natural forests as 'abnormal' and forests which are being managed for maximising production of marketable timber as 'normal' [Schlich cited in Shiva, 1993]. Shiva sees that 'normalcy' is determined by the demands of the market and the non-marketable components of the natural forest ecosystem are destroyed by 'scientific forestry'. The natural forest is seen as operating in 'chaos' and requires domination over it in order to put it in 'order'.

Such an ordering necessarily leads to uniformity and, from Maser's research, a reduction in the complexity and diversity of the forest[14] [Maser, 1994]. Maser places the blame at the foot of the Modern education system. "*Instead of training foresters to manage forests, we train plantation managers to manage the short-rotation,* ***economic*** *plantations with which we are replacing our native forests*" [Maser, 1994, p236]. For the scientific forester to conceive Nature as supplying perfectly good products on its own through its natural diversity, as do the local people in Shiva's experience, would appear to admit defeat. If this rationale was realised then there would no longer be a need to control Nature rather the foresters job would be to understand and nurture a forest as a whole organism rather than control and dominate over it [after Maser, 1994].

From his North American experience Maser [1994] sees the effect of this thinking and the practice as counter to sustainable forestry. "*Forests have evolved through the cumulative addition of structural diversity that initiates and maintains process diversity, complexity and stability through time. We are reversing the rich building process of that diversity, complexity and stability by replacing native forests with plantations designed only with narrow, short-term, economic considerations*" [Maser, 1994, p236]. Such plantations do not possess the large fallen trees of the old-growth forests which reinvest nutrient capital and ecological processes into the next generation of forest. Maser refers to examples in both Germany and North America where 'natural' forests which have been converted to short rotation plantations have yielded high volumes of wood fibre in the first rotation but in subsequent rotations these yields have declined steadily[15]. Their is a growing

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[14] It is acknowledged that plantation forests are not always monocultures devoid of biological diversity. In European and American forests a mixture of species are sometimes planted in alternative species and dead wood and dying wood is purposefully left for maintaining biological diversity [Spellerberg and Sawyer, 1995]. In New Zealand this practice is rare. It is also recognised that plantation forests are not 'biological deserts' as Allen *et al* [1995] claim is a preconception by some. However, it is the opinion of the author that such practices are often 'window dressing'; the ecological benefits of a row of Douglas fir or eucalypts on the roadside has to be question.

[15] In the New Zealand context, Rosoman [1994] suggests that without reinvestment of biological capital (such as nutrients and organic matter to the soil) in time this may also lead to a reduction in tree health and yields in later rotations of plantation forests. Definitive

belief amongst forest managers and researchers in New Zealand that on most sites pine plantations can be managed through successive rotations without a loss of soil quality through management techniques to retain and recycle soil nutrients and organic matter [O'Loughlin, 1994]. However Maser predicts, from the findings overseas, in the long-term yields in most plantation systems will invariably decline along with soil quality [Maser, 1995].

While many in the forestry industry would argue that monocultures are a source of wealth Shiva sees monocultures as "*a source of scarcity and poverty, both because they destroy diversity and alternatives and also because they decentralise control on production and consumption systems*" [Shiva, 1993, p6]. In other words, in Shiva's experience of Indian forestry monocultures not only remove the inherent wealth, diversity and alternatives from the forest but they also transfer this wealth into the hands of the rich and powerful. While not so forthright in his observation Ellen has detected the same pattern in Indonesia. "(T)*he control of the* (forestry) *system is becoming increasingly remote. Decisions regarding the location and level of extraction are made by agencies of central government, and within them individuals and committees in the highest echelons*" [Ellen in Milton, 1993, p133]. Shiva has observed that not only are "(i)*ndigenous silvicultural practices ... based on sustainable and renewable maximisation of all the diverse forms and functions of forests and trees*" [Shiva, 1993, p16] but such systems keep the wealth of the forests in the hands of the local people. She sees that forests which are controlled by those removed from them are inherently unsustainable. Not only are cultural and biological diversity subjugated but negative environmental effects are not directly felt by the decision makers themselves. Corrective actions are generally slow in coming, particularly if these effect profit margins.

It appears that in Modernist forestry local people are increasingly seen as part of

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conclusions have not been reached on the medium-term effect on yields of successive rotations, because of the low number of harvesting cycles which have taken place here. However, Smith [1994] hypothesised that changes in yield will vary from site to site because it appears that pine plantations can either degrade or improve soil quality over time depending on factors such as initial soil fertility and climate.

the problem not part of the solution. Their multiple objectives and wide range of uses of the diversity of natural forests often clash with those of industrial forestry and its single species and narrow objectives. In a European Forest Institute research report Kullervo Kuusela identifies one of the worst obstacles restricting efforts to improve the wood production function of forests as a "*heritage of multi-product management in which the material benefits are composed of wood, pasturing, mast, cork etc.,*" [Kuusela, 1994, p138]. Such a heritage, ie a history of local people using the local diversity of the forest, is seen by Kuusela as an "*obstacle to wood production* ***proper***" (emphasis added). He does not make any suggestions to rectify this 'problem' so that wood production 'proper' can take place but it is assumed that to marginalise these people in some way from the forest would be the 'logical' solution.

While this type of reductionist (or 'monoculture of the mind') thinking may be suitable for the management of plantation forests if this same sort of thinking is applied to New Zealand's indigenous forests with its associated single species single objective cognition, it is predicted that we will probably see a reduction in levels of biological diversity in the forests [after Shiva, 1993; Maser, 1994]. In New Zealand the results of 'monoculture thinking' applied to indigenous forest management appear to be beginning to come to light. Recently, Timberlands West Coast's management plan for its indigenous forests was released to the Parliamentary Commission for the Environment for an environmental audit. In their management plan Timberlands recognised two forest types under their control; rimu (*Dacrydium cupressinum*) and beech (*Nothofagus* sp.[16]). Under their sustained yield programme rimu is to be managed on a 500 year cycle and beech on up to a 120 year cycle. The 'beech forest' particularly in the north of the region, however, contains a small proportion of podocarps. These podocarps are proposed to be managed under the same schedules as the beech. Over time it is predicted

[16] While *Nothofagus* (or beech) forests are floristically the least complex of New Zealand's forests their biological diversity is not inherently monospecific. Of the 100 most characteristic species of the beech forest (both 'pure' and 'mixed' beech forest) 10 species which normally grow to large tree dimension and 13 trees which usually occupy a sub-canopy or occur as dominants on seral sites are included [Wardle, 1984].

that under such a schedule not only will the age of the oldest podocarps be reduced (along with the biota which depend on these) but perhaps the proportion of podocarps in these forests will similarly be reduced.

Shiva [1993] claims that monocultural thinking not only leads to a reduction in biological diversity but also a loss in cultural diversity. The implication for New Zealand's indigenous forests if this type of thinking is applied here is a retardation in the development of any present or emerging cultural diversity associated with these forests along with the loss of a diversity of possible economic opportunities which this diversity could supply. The other implication is that if single species, single objective indigenous forestry proves to be an economic success (however one measures this) it is surmised, from the experience of Shiva [1993], that under this paradigm the likelihood of these forests remaining in the hands of local people will be lessened. Once universal management systems are deduced and applied to indigenous forests for attaining a single product, ie wood, from a few species 'indigenous forestry' will probably become an attractive economic proposition for large forestry and sawmilling companies. The perception will be that these forests will be relatively easy to manage (or at least easier to manage than now). Where the diversity of the forestry is celebrated and used and more holistic thinking is applied this will probably not attract the large companies. It is surmised (from Shiva's experience) that under such a situation the wealth of the forest will remain in the hands of the local people who will have developed the local knowledge and traditions to make use of and maintain the diversity of the forest.

4.7 Dualistic Worldview

In the seventeenth century the question arose whether, and in what way, humans were at all distinguishable from the rest of Nature. René Decartes probably the most influential thinkers of the scientific revolution, reasoned that the fundamental difference between man and Nature was man's capacity to think. He thereby introduced a fundamental dualism in Modern thought; that of mind and

matter. "*Whereas matter was composed of primary, objectively-knowable, qualities, the mind was subjective and attributed secondary qualities to nature. Thus the* ***Cartesian dualism*** *involved mind and matter, subject and object, and it had a profound implication for the man-nature relationship because nature became composed of* ***objects metaphysically separated from man***" [Pepper, 1984, p51].

Therefore, for its own purposes science reduced the world to man and Nature, good and bad, black and white. Much of the legitimacy of science rests on such dualisms. The object/subject and scientific knowledge/wild knowledge are dualisms which have already been illustrated. Other examples of what some feminists [eg Merchant, 1979; Mellor, 1992; Plumwood, 1993] call the masculine/ feminine split are mind and body, culture and nature, reason and intuition, reason and emotion, civilised and primitive, and materialism and spirituality. A dualism is not simply a matter of a dichotomy or a difference between two contrasting pairs or even a simple hierarchial relationship. A dualism constructs one as superior to the dualised 'other'. It is thus a relationship of domination. Dualism aims to polarise the dualised spheres; to maximise the distance between them. It attempts to separate, to disguise any similarities and prevents the two spheres from being seen as continuous, inter-related or part of one another [Plumwood, 1993]. Plumwood cited what she believed to be the key elements in the dualistic structure of Modernist thought (see Figure 6 overleaf). Her list is not definitive. She claims that "*in the contrast set virtually everything on the 'superior' side can be represented as forms of reason, and virtually everything on the underside can be represented as forms of nature*" [Plumwood, 1993, p44].

According to Plumwood [1993] the purpose of the dualistic worldview that science has created is essentially one of power. Through dualism science has been able to lay claim to reason and produce 'truths' about reality. In order to maintain this superior position as the only legitimate creator of truth it has been necessary for science to dominate and suppress the 'Other'. In science objectivity, rationality and suppression of emotionality are highly valorised [Plumwood, 1993] while subjectivity, intuition and emotion are attached to negative associations [Mellor,

1992; Plumwood, 1993]. Mellor [1992] argues that this division between reason and Nature has "*allowed the unrestrained development of science and technology, industry and militarism*" [Mellor, 1992, p54].

culture	/	nature
reason	/	nature
male	/	female
mind	/	body (nature)
master	/	slave
reason	/	matter (physicality)
rationality	/	animality (nature)
reason	/	emotion (nature)
mind, spirit	/	nature
freedom	/	necessity (nature)
universal	/	particular
human	/	nature (non-human)
civilised	/	primitive
production	/	reproduction (nature)
public	/	private
subject	/	object
self	/	other

Figure 6. Key elements in the dualistic structure in western thought [Plumwood, 1993, p43]

Lynn White Jr [1967] proposed the idea that both science and Christianity have developed on the premise that humans are not part of Nature; we are seen to exist outside of and beyond Nature. This 'hyperseparation', as Plumwood calls it, between humans and Nature was essential to the Modernist project of progress. When one sees themselves as part of Nature the possibilities of exploitation and domination are diminished[17] [Pepper, 1984; Mies and Shiva, 1993; Plumwood, 1993]. This human/ Nature (or culture/ Nature) separation, has generally had disastrous consequences for the Nature side of the dualism. "*The ecological crisis*

[17] Mies and Shiva consider that the separation of Man from Nature was suited to the exploitation imperative of growing capitalism, however, the author sees that the separation was equally suited to the development of Marxism, socialism and communism.

is rooted in the mistaken belief that human beings are not part of the democracy[18] *of nature's life, that they stand* ***apart*** *from and* ***above*** *nature*" [Mies and Shiva, 1993, p265]. This dualism has allowed humans to dominate Nature and dominate other groups of humans and aspects of human life which are cast as close to Nature [Redclift and Sage, 1994]. Such a hierarchical dualistic construction of the world, however, plays no small part in the unsustainable state we find ourselves [Mellor, 1992; Plumwood, 1993].

Such a construction of humans and their relationship with nature has not always been so. Religion and science, prior to the Enlightenment project, placed people more firmly in the realm of Nature; the culture/ nature split did not exist in the minds of people. **This relationship has arisen in order to legitimise and advance the recent industrial and technological revolutions**. This 'hyperseparation' has enabled immense changes in technology. Unfortunately this has been at the expense of the Nature side of the dualism. Science has, thus, rationalised away our inter-relatedness with nature in order to dominate over it without moral reprieve [Plumwood, 1993].

Vandana Shiva identified three dualisms which have particular implications for the forestry discipline. Two of these have been referred to in a greater or lesser extent. These are the scientific knowledge/ wild knowledge split, and the uniformity/ diversity split. The third split, the forestry/ agriculture (or timber/ food) separation was necessary for the discipline of forestry to develop in the first place. Such a split has undoubtedly led to advances in our ecological understanding of forests and the production of woody biomass. However, it must also be remembered that such a split is a scientific construct which was created to enable us to understand things from a particular standpoint. For many people around the world the forestry/ agriculture dichotomy is not part of their reality;

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[18] What Mies and Shiva [1993] mean here by '*democracy* of nature' is the view that we must respect and use Nature without abusing it. They are not presenting a challenge to the hierarchy of Nature that ecology refers to by they are saying that in order to avoid the 'ecological crisis' we must develop a more equal relationship with Nature than the majority of the Modern industrialised world's populace does at present.

they are both part of a whole. "*In the 'scientific' system which splits forestry from agriculture and reduces forestry to timber and wood supply, food is no longer a category related to forestry. The cognitive space that relates forestry to food production, either directly, or through fertility links, is therefore erased with the split. Knowledge systems which have emerged from the food giving capacities of the forest are, therefore eclipsed and finally destroyed, both through neglect and aggression*" [Shiva, 1993, p14]. Merchant [1992] notes that the emerging science of agroforestry is an attempt to repair the split between forestry and agriculture. However, it is argued that while the other dualisms and reductionist thinking remain their reunion will probably only be superficial. Vandana Shiva [1993] writes of similar efforts in India to link people and forests through 'social forestry' programmes. In her experience these have failed because of the reductionist (or single-species, single commodity) type of thinking and the continuation of the hierarchial dualisms which have prevailed.

The separation of scientific knowledge and wild knowledge probably began previous to Descartes's reasoning split them forever. Shiva argues that the dualism remains in place because scientific knowledge is seen as universal and possessing universal laws; it is deemed to be applicable to all situations. However, she identified a major flaw in this construction of reality. "*The universal/local dichotomy is misplaced when applied to the western and indigenous traditions of knowledge, because the western is a local tradition which has spread world wide through intellectual colonisation*[19]" [Shiva, 1993, p10]. Science has a vested interest in maintaining this dualism in order to remain all supreme. If it is accepted that science is not the 'truth' but simply a social construct [after Redclift in Redclift and Sage, 1994] then on this basis scientific knowledge does not have any greater legitimacy over wild knowledge. It could even be argued that it has less legitimate simply because it dominates the other.

The third dualism which is the main focus of *Monocultures of the Mind* is the

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[19] Intellectual colonisation is the process by which local world views are suppressed by, and in favour of, the dominant world view (of capitalism, science, technology, philosophy etc).

uniformity/ diversity split. Shiva contends that "(t)*he industrial materials standpoint is the capitalist reductionist forestry which splits the living diversity and democracy of the forest into commercially valuable dead wood and destroys the rest as 'weeds' and 'waste. This 'waste' however is the wealth of biomass that maintains nature's water and nutrient cycles and satisfies needs of food, fuel, fodder, fertiliser, fibre and medicine of agricultural* (and forest) *communities*" [Shiva, 1993, p24]. While 'near natural' forest management systems endeavour to retain a more diverse forest this is generally only in terms of producing woody biomass from a relatively few species of 'preferred' trees.

Monoculture plantations are seen to be the penultimate form of forestry because of the high volumes of timber which may be produced in comparison to 'near natural' systems of forest management. However, single species plantations are necessarily less diverse than the natural forests which they replace[20] [Maser, 1994]. Maser calls intensive plantation management a 'child of short-term economics' in which the entire focus is on fast-grown wood fibre. Anything outside of this focus is considered to be an economic failure. Further, he claims that sustainable forestry and plantation management are not only not conducive to one another they are opposites[21]. "*Product extraction is maximised in traditional plantation management and the sustainability of the forest is minimised. In sustainable forestry, however, sustainability of the forest is maximised and product extraction is performed at a level and in a way that does not impinge on the*

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[20]Sweeping claims that *Pinus radiata* plantations in New Zealand are 'biological deserts' are not supported by the scientific evidence [Allen *et al*, 1995; O'Loughlin, 1995]. Limited research in New Zealand has shown that plantation forests are often or can sometimes be biologically diverse (depending on one's information source) [Rosoman, 1994; Allen *et al*, 1995; O'Loughlin, 1995]. Given a seed source an understorey of indigenous vegetation will often develop within plantations. Such a forest structure is generally short-lived, however, due to harvesting at between 25 and 30 years. Short rotations do not allow the development of canopy and emergent flora (such as the podocarps) and their associated flora fauna. Further, the bird species found in plantations tend to depend on adjacent indigenous habitat, require an indigenous understorey or are generalists in terms of habitat and food requirements [Rosoman, 1994].

[21] Maser does, however, offer practical solutions in overcoming what he refers to as the inherent 'unsustainability' of plantation systems. See section *4.11 Postmodern Forestry* for examples.

sustainability of the forest" [Maser, 1994, p285].

4.8 Mechanistic Worldview

During the mid-seventeenth century science began to conceptualise the natural world as a series of machines in motion [Mellor, 1992]. This was due partly to the influence of Descartes's man/ nature dualism coupled with an increasing experience of western Europeans with clocks and other modern machines [Merchant, 1980, 1992]. This "*new conception of reality ... shared a number of assumptions with the clocks, geared mills, and force-multiplying machines that had become an important part of daily European economic life*" [Merchant, 1992, p49]. Nature and animals were constructed as mindless machines without value or direction on their own account [Plumwood, 1993]. Understanding of Nature was achieved through Newtonian logic by taking the machine to pieces to see how it worked. Methods of inquiry were also developed with the Nature-as-machine construction of reality in mind [Pepper, 1984]. Today Modern science's model of Nature as a machine and methods of inquiry based on this construction essentially remain unchanged from the mid-seventeenth century [Rees, 1990; Merchant, 1992]. As scientific orthodoxy holds onto this mechanistic construction of Nature Harding [1991] argues its reality generates distortions of both Nature and inquiry. Rees [1990] calls this construction "dangerously superficial".

Nature being conceived as mindless and without direction does not simply support human utilisation of Nature but gives licence to control, normalise and annex it without constraint [Plumwood, 1993; Merchant, 1992] "*The machine image confirms the confidence in control as well as the narrow and instrumental view of nature associated with a technological outlook. The machine's properties are contrived for its makers benefit, and its cannons of virtue reflects its users' interests. If well made, it contains few surprises and superfluities: it does not outrun us, and we can hope to attain a complete knowledge of it. A machine is made to be controlled, and knowledge of its operation is the means to power over*

it" [Plumwood, 1993, p 109].

Nature as a machine and its ensuing worldview rationalise away any conceptualisation of Nature beyond it being a mere thing, a commodity, for human use [Plumwood, 1993; Maser, 1994]. Previous to the scientific revolution the organic view of Nature helped to restrain exploitation, however, the Nature-as-machine metaphor has loosened this restraint [Mellor, 1992]. As an analogy of a machine Nature is seen as lacking any qualities associated with that of humans. It is conceived of as passive, non-creative and inert. It is devoid of any characteristics of mind or thought and lacks any goals and purposes of its own. "*The human realm is one of freedom, whereas the realm of nature is fixed and deterministic, with no capacity for choice*" [Plumwood, 1993, p110]. Without its own autonomy Nature does not require us to accord it respect and actively attracts control over it. "*If it lacks its own goals and direction, it can impose no constraints on our treatment of it; it can be seen as something utterly neutral on which humans can and even must impose their own goals, purposes and significance. It represents a teleological vacuum, into which human ends must enter. Thus a mechanistically conceived nature lies open to, indeed* ***invites*** *the imposition of human purposes and treatment as an instrument for the achievement of human satisfactions*" [Plumwood, 1993, p110].

Modern science holds that Nature, as a metaphor of a machine, behaves in a predictable way according to laws which determine it and supports the assumption of rational order in Nature [Pepper, 1984; Merchant, 1993]. These laws are most easily described in Modern science through mathematics. As such mathematics has become the language of science [Pepper, 1984]. Computers and computer modelling have become pervasive in science, including forestry, due to their power to process mathematics. Daly and Cobb have observed that mathematical models and computer simulations have become the hallmark of current practice in the discipline of economics. They conclude that "(s)*uch elaborate and beautiful logical structures heighten the tendency to prize theory over fact and to reinterpret fact to fit theory*" [Daly and Cobb, 1989, p38]. If Daly and Cobb's observation of economics

is applied to forestry we could be in danger of developing a discipline which reduces trees to numbers and simulations, with forests controlled not by Nature and people in Nature but by machines.

Bertens argues that the computerisation of society will affect the nature of knowledge. He says that "*It is not very clear how exactly our knowledge will change, but Lyotard offers the prediction that 'the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language*'" [Bertens, 1995, p123]. From this one can make the assumption that knowledge which cannot be computerised will be marginalised and under-valued. Wild knowledge will necessarily fall into this category as it rarely describes itself through numbers and mathematics. Computers can only process information which is quantifiable and context-independent. Modernist science thus depends on a reality of Nature which is rigid, limited and restrictive (like a machine) [Merchant, 1993].

The type of forestry which is most conducive to this mechanistic image of Nature and is most easily able to be simulated through computer is the plantation system. According to Shiva the plantation system mirrors the industrial factory[22]. In her experience in India this conceptualisation has lead to problems both for the forest and the local people who depend on the forest. "*The existing principles of scientific forest management leads to the destruction of the tropical forest ecosystem because it is based on the objective of modelling the diversity of the living forest on the model of the assembly line*" [Shiva, 1993, p19]. As a model of the industrial factory "(t)*he forest no longer* (has) *a value in itself, in all its diversity. Its value* (is) *reduced to the value of commercially exploitable industrial timber*" [Shiva, 1993, p17]. Like the cogs in a machine forest workers specialise in a single role and the forest in turn specialises in a single species so as to increase 'efficiency'. "*In place of cultural and biological pluralism, the factory produces non-sustainable monocultures in nature and society. There is no place for the small, no value for*

[22] Two prevalent metaphors of plantation systems are a 'factory without a roof' and 'wood factory' [Allen *et al*, 1995; Rosoman, 1994].

the insignificant, Organic diversity gives way to fragmented atomism and uniformity. The diversity must be weeded out... Symbiosis must give way to competition, domination and dispensability. There is no survival possible for the forest or its people when they become feedstock for 'industry" [Shiva, 1993, p19]. Monocultures, according to Shiva, destroy their own basis, they do not produce the conditions by which they can reproduce themselves sustainably and they become a prescription for non-sustainability.

4.9 Grand narratives

One of the central tenets of postmodern theory is what Jean-François Lyotard described as 'grand narratives' or 'metanarratives' [Bertens, 1995; Kumar, 1995]. Grand narratives have been described as "*the supposedly transcendent and universal truths that underpin western civilisation and that function to give that civilisation objective legitimisation*" [Bertens, 1995, p124]. According to Kumar grand narratives are couched in homological (or 'same reason') universals.

Such homological universals abound in the Modern scientific view of the world. It seems that much of the appeal of grand narratives of modernity comes from their association with science [Kumar, 1995]. The Nature-as-machine metaphor supports the assumption of a certain type of rational order in Nature, and as such nature is subject to mathematical law-like behaviour which is seen as universal [Merchant, 1993]. Pepper gives the example that "*Newton formulated not the law of gravity but the law of universal gravitation*" [Pepper, 1984 p52]. Newton's theory of gravity was influenced by the falling apple but he comprehended how the sun, moon and all bodies moved. Thus he created a universal law about gravity no just the reason behind an apple falling to the ground.

This idea of universal laws existing within Nature was first developed within Newtonian physics. The spectacular success of physics led to this and other ideas of physics (ie quantitative methods and positivism) becoming part of the

unquestionable set of assumptions on which the other natural sciences are based [Rees, 1990; Harding, 1991]. As the 'softer' social sciences emerged they also took on board the methods and basis of the natural sciences.

Out of this same mode of thinking, ideological and political grand narratives, such as Marxism, liberalism, capitalism and communism, emerged. However, such large-scale ideological constructs did not last. During the 1940's and 1950's these began to be questioned. The grand narrative of Marxism in particular was attacked for its theoretical shortcomings and historical implausibility [Kumar, 1995]. In more recent times the 'untruths' of the other grand narratives of politics have also been exposed. There has been widespread disengagement and disillusionment with politics and political ideologies (or grand narratives) as they have found to be lacking in legitimacy [Bertens, 1995; Kumar, 1995]. These grand narratives contain 'untruths' and lack legitimacy in the sense that they have either outlived their usefulness or their ethical basis for their existence. They have failed to adapt or co-evolve with the changing bio-physical, social and economic dimensions in which they exist. Kumar sees that this has not prevented the powerful ideology of progress from attaching itself to the ideas of 'modernisation' and 'industrialisation', however. In this guise he sees the grand narrative of progress "*enjoy*(ing) *a flourishing career*" despite not being tied to any political ideology [Kumar, 1995, p134].

Somehow science appears to be seen as the unquestionable or sacred grand narrative and has remained untouched as "*the sole guarantor of progress and prosperity*" [Kumar, 1995, p134]. However, cracks are beginning to appear - and from the least likely quarters, that of physics - the science from which all other sciences are derived. Quantum theory, relativity theory and the new thermodynamics of Ilya Prigogine all challenge the mechanistic view of Nature and other assumptions of classical physics [Merchant, 1992]. The recent findings of physics have concluded that the mechanistic universal model of reality may deal "*adequately with closed systems that are isolated from their environments - situations in which small inputs result in small outputs that can be described by*

linear mathematical relationships" [Merchant, 1992, p95]. In contrast most biological and social systems are open, not closed. It is becoming apparent that many of the laws of physics are in fact context dependent and are, therefore, not universal. The exposure of the myth of universalism and the mechanistic view of Nature by physics has repercussions for the grand narrative of 'Science', the various disciplines of science and their assumptions. This is one of the reasons why the understanding of sustainability through the grand narrative of science is flawed.

But if we were to abandon the idea of grand narratives and universal rules what would replace them? Kumar [1995] optimistically suggests Lyotard's 'little narratives' (or *petits récits*). Little narratives are created and comprehended through customary or local knowledge. They are contextual, provisional and bounded. Often they accept what according to scientific logic would be called false reasoning and illogical arguments. However, they have their own internal logic which is specific to a place, a history and a unique mix of rationalities, traditions and ethics. "*Little narratives - as in truth all, narratives shorn of their scientific pretentions - do not depend on external, objective validation but are internal to the communities within which they occur. They determine their own criteria of competence and define what has the right to be said and done - that is, they are self-legitimising*" [Kumar, 1995, p136].

4.10 Summary

Michael Redclift wrote "*The idea of sustainability is derived from science, but at the same time highlights the limitations of science*" [Redclift in Redclift and Sage, 1994, p17]. This chapter has been concerned with highlighting these limitations. It is argued that with these shortcomings of Modernist science exposed we can then begin to move from a weak sustainability paradigm to a strong sustainability paradigm. An unquestioned holding on to the assumptions and methods of inquiry of Modernist science will result only in weak sustainability in practice. A total

rejection of Modernist science as some of the early postmodern theorists advocated will fare little better; probably worse. In order for us to move towards a strong sustainability paradigm it is believed that 'new' 'Postmodern' sciences, including forestry science, will be required. Such Postmodern sciences would be both deconstructive, in the sense that they would question the basis of our understanding of reality and accept a diversity of narratives, as well as being reconstructive through a review of Modern premises and traditional concepts [after Griffin in Orr, 1992]. A Postmodern science would thoroughly question the grand narratives of science, in particular those of modernisation, industrialisation and the idea of progress.

A number of changes to the present way that knowledge is created and legitimised will be required to bring about such a 'Postmodern science', however. The first and major change required will be the acknowledgement that the subject/ object dualism is a construct; it is a reality which has been created by Modern science to meet its own ends. Initially the dualism was created in order for science to understand the world from a particular perspective but now it is also used to confer science its supreme legitimacy through the notion of objectivity. Once the subject/ object dualism is exposed science becomes one amongst many ways of knowing and constructing the world. Continuing to construct the world from a narrow 'value-free' scientific standpoint where the stakeholders are cloaked in objectivity will more than likely continue to lead to weakly sustainable 'solutions'.

It is more probable that a construction of the world in which subjectivity and values are declared rather than hidden and assumptions about the observer are made explicit will get us closer to a path of strong sustainability. According to Harding [1991] and Hubbard [1988] objectivity is actually strengthened by declaring subjectivity. "*More objectivity is in fact obtained by bringing values out into the open and discussing them than by denying their formative presence*" [Hubbard in Gergen, 1988, p12]. The challenge for a Postmodern science is not to reject objectivity outright but to be aware that subjectivity and context cannot be stripped away from science as these are part of being human [Hubbard in Gergen,

1988]. To declare our subjectivity does not allow or enable us to disengage from the consequences of our behaviour as Modern science has allowed us to do [after Redclift in Redclift and Sage, 1994]. Perhaps a method of inquiry which respects and includes human values and other values intrinsic in Nature will see the end of weapons of mass destruction, virulent chemicals in the environment and deforestation in the name of progress.

A Postmodern science would give positive value to Nature and the wild knowledge of local and indigenous peoples interpretation of Nature. It would not label their understanding as superstitious, 'unscientific' or emotional. A Postmodern science would be inclusive of and give legitimacy to many forms of knowledge and narratives. Knowledge and science and the creation of it would not be the exclusive domain of a narrow segment of society but encompass many people and many rationalities. It would not subjugate or dominate over wild knowledge but try to build on local peoples unique economic, biophysical and social mix of realities. It would create channels for the transfer of information from many narratives, including both scientific and wild knowledge, in order to encourage a process of continuous adaptation and co-evolution in a search for sustainability.

In the words of Vandana Shiva "(t)*he survival of the tropical forests depends on the survival of human societies modelled on the principle of the forest. These lesson do not come from text of 'scientific forestry'. They lie hidden in the lives and beliefs of the forest peoples of the world*" [Shiva, 1993, p19]. The author, however, argues that 'scientific forestry' does have somewhat more to offer than Shiva presupposes. However, for its contribution to be fully realised the definition of 'scientific' and 'forestry' both need to be expanded. Within a Postmodern science scientific knowledge must be seen as another form of knowledge and not the supreme knowledge. Neither scientific knowledge or wild knowledge should be allowed to dominate, they should simply be seen as different ways of understanding.

A Postmodern science would take a more holistic approach than Modern reductionist science is able to take. This is particularly relevant in the context of

natural resource and environmental problems which are inherently holistic in nature. Such a science would include synthesis and holism rather than simply focusing on analysis and reductionism. It would see the whole as greater than the sum of its parts and to isolate a part from the whole would be seen as potentially making the whole meaningless [after Pepper, 1984]. It would see the whole as undefinable and immeasurable. It would value things that cannot be observed, measured and modelled in the same way that Modern science at present values those things that can. The objectives of a Postmodern science would not be reduced to a single economic imperative, rather they would be multifaceted in nature.

From this discussion it appears that the construction of reality through the dualism of Man and Nature has played a large part in the unsustainable state in which we find ourselves. The concept of Nature as a separate entity is, however, a human invention and should be recognised as such; it exists only in the Cartesian mind. A Postmodern science which does not split the world into separate dualisms where one dominates and subjugates the 'other' as inferior but simply as different is required. A Postmodern science would not abandon dichotomy or difference to avoid dualism. To do so would absorb one into the other, probably at the expense of the 'other' [after Mellor, 1992; Plumwood, 1993]. Plumwood sees that the breaking of such dualisms involves both affirming and reconceptualising the underside. The challenge for Postmodern science is how to give positive value to the 'other' without reversing values [Plumwood, 1993]. Postmodernist science should not be constructed as the opposite of Modernist science. To do so would create another dualism and reject the importance of the Modernist way of thinking. Modernist science would become one narrative amongst many narratives each appropriate in their own context.

A Postmodern science would question the present mechanistic view of Nature which pervades Modern science. As Harding [1991] has observed its current metaphors generate distortions of both Nature and inquiry. The construction of Nature as a machine has allowed us to control, normalise and annex it without constraint; to see it as a mere thing for human use. A Postmodern science **may**

construct Nature as an organic and dynamic web of interrelated events, with attributes which align it more to a human being who has inherent and intrinsic rights than a machine that requires control. Other metaphors may equally be appropriate, however, depending on the time and context. Nature would have a right of existence for its own sake and be deserved of the respect which we would expect other humans to give oneself.

4.11 Postmodern Forestry

This brings us to the question is there or could there be such a thing as 'Postmodern forestry'? J.H. Wikstrom commenting on murmurings of change in US forestry in *Moving into the Post-Modern World* appears to think so. He said that sustainable "(s)*olutions will depend on a fundamental change in the way people think, on a new theoretical framework consistent with the way nature functions*" [Wikstrom, 1987, p65]. He proposed that sustainable forestry will not come about simply by applying Modernist science to forests. What is required is a whole new way of thinking about Nature; one where Nature is seen as a dynamic and integrated synergistic system rather than a closed mechanistic system [Wikstrom, 1987]. Chris Maser agrees with Wikstrom. He sees that we have to devise a new paradigm where we "*view the forest as a living organism with which we cooperate and through such cooperation are allowed to harvest products as the biological capacity of the forest permits*" [Maser, 1994, p239].

It may be argued that the perspectives that these people offer are not new and they may be found in the volumes of 'Classical forestry'. However, two things have been observed from this inquiry. The first is that while some of the ideas of a 'Postmodern' forestry science **may** be found in the early forestry texts the trend today of Modernist forestry in New Zealand today is increasingly a reductionist one; one which reduces forests to monocultures of preferred species within a narrow economic/sustained yield context (even those that advocate near natural forestry management systems). The second and main difference between Classical

and a Postmodern forestry is that Classical forestry management is based on the assumptions of Modernist science. While a Postmodern forestry would not denote a total rejection of both Modern and Classical forestry it would require a rethink about the assumptions upon which they are based.

A Postmodern forestry would necessarily be holistic in its thinking. While a multiple use philosophy was developed in New Zealand during the 1920's, out of a concern for recreation needs, and later in the 1950's for amenity and ecological values (particularly water and soil conservation) the focus was essentially on timber production and the conversion of indigenous forest to exotic [Ali Memon and Wilson, 1993]. Tilling [1992] The current separation of commercial and non-commercial forest lands, the abolition of the New Zealand Forest Service and the Department of Lands and Survey and the subsequent privatisation of much of the commercial forests[23] has served to further damage the forestry profession's image as a 'champion of multiple-use'. A Postmodern forestry would re-assert its multiple-use role but it would go much further than this. Rather than multiple-use a Postmodern forestry discipline would define itself in terms of multiple-protection. That is it would endeavour to protect all values whether for use or otherwise. In *Monocultures of the Mind* Shiva [1993] describes an alternative forestry science which is orientated to the public interest and ecological in nature. "*In this alternative forestry science, forest resources are not viewed as isolated from other resources of the ecosystem. Nor is the economic value of the forest reduced to the commercial value of timber. 'Productivity', 'yield' and 'economic value' are defined for integrated ecosystem and for multi-purpose utilisation. Their meaning and measure is therefore entirely different from the meaning and measure employed in reductionist forestry*" [Shiva, 1993, p21]. It is argued that such an alternative forestry science is already beginning to emerge

A Postmodern forestry would seriously challenge professional specialisation (for reasons given by Wikstrom) and encourage interdisciplinary approaches including

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[23] See chapter 6 for an account of the development of indigenous forest policy in New Zealand.

both professionals and lay people. The discipline would acknowledge that the whole is greater than the sum of its parts (an essential understanding of sustainability according to Maser) and that sustainability is thus unlikely to be realised through professional specialisation at least in the way that it operates at present. A Postmodern forestry would also seriously question the rationalities of exotic plantation management, though not in order to reject it. Although Maser [1994] argues from his experience that "(s)*ustainable forestry is the opposite of plantation management practised today*" [Maser, 1994, p238] he does offer theoretical and practical solutions to address this situation. His solutions focus on mimicking or simulating Nature's processes to attain both biological sustainability and sustained yields of a variety of products through time. A practical example is his suggestion, to combat both the depletion of the soil and biodiversity by plantation systems, to after every two or three economic rotations an extended rotation would be put in place to allow the forest (or compartment) to reach the old-growth stage. "*Such an extended rotation* (would theoretically allow) *the biological processes to heal and also allow the reinvestment of biological capital in the soil to recapitalize the organic material and the soil's savings account of available nutrients in the soil*" [Maser, 1994, p298] much the same way a farmer leaves a paddock fallow after a number of years of cropping.

In Postmodern forestry the local people and their rationalities would be seen as part of the sustainable 'solution'. In New Zealand the first foresters were undoubtedly the Maori. They utilised the forest for food, medicines, timber, and building materials [Best, 1942]. Much of their forest knowledge has been undermined and lost, at least in part, due to the domination of Modern science. Given the opportunity, however, much of this knowledge could be 'rediscovered' along with new knowledge which has a relevance to people living and working in indigenous forests today. One dimensional thinking, as Shiva has observed, may result in a higher volume of 'defect' free timber of merchantable species being extracted from our indigenous forests but it is unlikely that it will promote the development of a knowledge system based on the wonder of the diversity of the forest. A knowledge system which utilises (and non-utilises) the fungi, mosses,

insects, 'non-merchantable' species, non-merchantable parts of the merchantable species, takes advantage of tourism opportunities and is tied in with culture, agriculture and preservation of New Zealand's indigenous forests must necessarily be multidimensional in thinking. Such a knowledge system would be composed of many rationalities rather than a single rationality focused on timber supply and demand. For such a knowledge system to evolve it must not be marginalised or simply 'taken into account' but placed on at least an equal footing with the dominant Modern forestry paradigm so that it can evolve freely. According to Vandana Shiva such local knowledge based systems keep the wealth of the forests in the hands of the local people. She sees that forests which are controlled by those removed from the forests are inherently unsustainable because cultural and biological diversity become subjugated. Further, where decision makers are distant from the forest and do not feel the effects of negative externalities directly upon themselves corrective actions to mitigate these effects are generally slow in coming, particularly if these impinge on profit margins (see Chapter 5 for an example).

In short a Postmodern forestry would declare its subjectivity (rather that hiding in objectivity); it would include many rationalities (rather than a predominantly economic one); it would possess genuinely holistic characteristics (rather than singularly reductionist ones); it would treat human beings as an equal part of Nature (rather than existing outside and above Nature); it would question the construction of Nature as a machine and suggest other more appropriate and contextual metaphors. It would seek 'little truths' particular to the economic, ecological and social realities of particular localities rather than seeking universal truths. The role of the Postmodern forester would be to try and understand these 'little narratives', whether biophysical, social, economic or otherwise and integrate these into her/his forest in order to minimise the biophysical fluctuations while maximising social and economic opportunities. Through this process it is viewed that the diversity of the forest, the diversity of society and the diversity of economic opportunities can all be maintained.' It is argued that such a Postmodern forestry would be a strongly sustainable forestry.

Maser reiterates throughout his book *Sustainable Forestry* that a sound understanding of sustainable forestry can be found in the following premise. "*A biologically sustainable forest is a prerequisite for a biologically sustainable yield (harvest). A biologically sustainable yield is a prerequisite for an economically sustainable economy, which, finally, is a prerequisite for an economically sustainable society*" [Maser, 1994, p199]. An alternative Postmodern forestry would change not only what we do in practice but more importantly how we think about Nature and our place in it.

" *Mountains draped in majesty, Their mantle is the bush.*
Nay not with a casual glance, But in a questing search.
To open the mind and comprehend, touch the depth and grasp the potential,
To harvest with tenderness and sustain with true knowledge
This is offered freely in her bounty ..." Jackie Pettigrew, Glenhope.

5.0 Case Study; Glenhope Native Forest

5.1 Précis

Forest: Glenhope Native Forest

Location: Lamb Valley, Glenhope, near Nelson

Owners: Jim Pettigrew and Lee Pettigrew.

Others: Peter Topping (Forest Manager), Roger May (Management Plan), Andrew Jolly (Mill Operator), Simon (Harvesting and Silviculture).

Area: 884 hectares

Class: Beech - Podocarp - hardwood. Mixed beech species and hybrids predominate with occasional emergent podocarps and an understorey of small hardwoods on some sites.

Species: Silver beech, tawhai, *Nothofagus menziesii*
Red beech, tawhairaunui, *N. fusca*
Hard beech, tawhairaunui, *N. truncata*
Black beech, tawhaitauriki, *N. solandri*
Kanuka, *Kunzea ericoides*
Rimu, *Dacrydium cupressinum*
Kahikatea, White Pine, *Dacrycarpus dacrydioides*
Matai, *Prumnopitys taxifolia*
Totara, *Podocarpus totara*

Terrain: Moderately steep hill country, generally in the range 16° to 25°, though up to 35° in places. Altitudinal range 400 - 580 metres asl.

Climate: Mild summers, cool winters with occasional snowfalls and frequent

frosts. Rainfall averages 1,550 mm per annum. Predominant winds; Southerly, Sou-west and Nor-west, gales are infrequent. Mean daily temperature is 12.0°C (16.8°C mean daily maximum and 4.8°C mean daily minimum).

Soils: 45bH, 44cH, 33g. Strongly leached yellow-brown earths, podzolised yellow-brown earths and podzols.

Geology: Moutere gravels; tertiary calcareous parent material, soft mudstone, sandstone and uncemented gravel.

Erosion: Negligible to slight soil slip erosion

Access: Good roading system to forest suitable for trucks, 4WD vehicles and 2WD vehicles except during the wetter parts of the year. Roading network exists within forest from industrial forestry days but unsuited to sustainable management.

Distance to Markets: Tapawera (Timber reprocessing factory) 40kms. Nelson 95kms (Port). Picton 160kms (Port).

5.2 A general account of the current natural history of mixed beech forests[1]

The inland forests on the low and mid-slopes of the north-west Nelson region are dominated by red beech (*Nothofagus fusca*), silver beech (*N. menziesii*) and hard beech (*N. truncata*) with scatterings of black beech (*N. solandri* var *solandri*), mountain beech (*N. solandri* var *cliffortioides)* and podocarp species. The species are not evenly distributed over the region; the beech species present on any given site being essentially a function of altitude, drainage, the underlying parent rock and soil fertility [Wardle, 1984]. Silver beech tends to be found at higher altitudes, on wetter (though not water-logged) sites and on soils of lower fertility than red beech [McKelvey, 1995]. Red beech prefers the deep well drained soils and sunny

[1] Locally the beech forest is often called birch forest, probably as an historical reference to its resemblance to the northern hemisphere species.

north facing ridge-lines and rarely reaches the timberline. Where red beech is common, silver beech is generally a slower growing subdominant winding its way up through the red beech [Topping pers com]. Hard beech (*N. truncata*) is also a prominent species of the north-west Nelson forests particularly in the western portion of the region [Hinds and Reid, 1957]. It has similar requirements to that of red beech, though for it to be the dominant species, it requires the winters to be somewhat milder than does its close relative [Wardle, 1984]. Black beech is able to tolerate the drier and more exposed sites, such as on ridge tops and spurs, where it is often the dominant species [Wardle, 1984].

With increasing rainfall and decreasing altitude the variety of plant species within the forests of the north-west Nelson region increases. In the west of the region, where the rainfall is higher and the altitude lower than that of the east, the number of species is greater as is the complexity of the forest structure [Wardle, 1984]. Conversely, in the east of the region, where the climate is drier and the altitude tends to be greater the variety of species is generally less. At the confluence of these extremes, in the rainshadow of Kahurangi National Park, the forests are dominated by the red and silver beeches with occasional hard beech and black beech. Below 600 metres the emergents rimu (*Dacrydium cupressinum*) and matai (*Prumnopitys taxifolia*) become increasingly important on the well drained slopes and kahikatea (*Dacrycarpus dacrydioides*) and silver pine (*D. colensoi*) on the poorly drained sites. The inland mixed beech forests of North West Nelson forest have a typical understorey of *Griselinia littoralis, Pseudopanax simplex, Pseudopanax crassifolius, Coprosma foetidissima, Myrsine divaricata, and Pseudowintera colorata* [Wardle, 1984]. This general forest type description typifies the forests of the Glenhope area.

The phenomenon of disturbance is the most commonly mentioned factor of the ecology of this forest type. It is emphasised both in the literature [Wardle, 1984; Stewart, 1986; Hosking, 1989; Duncan and Stewart, 1991] and with discussions with both forest ecologists and forest owners [Benecke, Topping, Wardle (all *pers comm*)]. However, there appears to be different explanations to the nature of the

dynamic. One theory maintains that there is ongoing collapse of small stands of trees with each collapse related to a critical age and a vector of destruction such as wind, snow or pathogen attack. At Glenhope this pattern is born out by the observation of a patched mosaic of groups of trees of similar ages and similar conditions of health [Topping, pers comm][2].

Another theory is that collapse (when it occurs) rather than being confined to small stands of trees, is widespread and catastrophic. Rather than being a continuous process it is a rare event. It may be triggered by snow, landslide, wind or drought, causing damage within an initial area, leading to the build up of pathogens in the collapsed material and later an outbreak into the surrounding forest followed by extensive forest collapse. [Wardle, *pers comm*]. An often cited example of this pattern occurred in the Maruia Valley in the mid 1970's following a series of droughts which led to an outbreak of the scale insect *Inglisia fagi*. Widespread insect infestation followed within some areas of beech forest, of up to 10km^2 in size, leading to extensive damage and dieback [Hosking and Kershaw, 1985].

These different explanations have significant implications for the management of the mixed beech forests. Benecke, Topping and Wardle agree that human intervention should mimic those natural processes which are occurring within the forest ecosystem [all *pers comm*]. As such, the coupes selected for harvesting should as far as possible reflect the natural catastrophes and subsequent gaps which occur within the forest beyond the direct influence of humans.

Whilst the evidence in the Maruia Valley supports the theory that large catastrophes do sometimes occur it should also be noted that in this case it did not lead to the total destruction of all species and age classes within those areas affected. This red/silver beech forest possesses an uneven age structure with a mix of species, seedlings, saplings, poles, mature trees and old-growth trees; of which

[2] Generally the stand size in Glenhope Forest is between 4 and 8 mature trees in number and less than .15 hectares in area.

it was the old-growth red beeches which were mainly affected. Today there are significant areas containing large dead red beech spars indicating the extent of the catastrophe. However, dispersed within these areas there remains many silver beeches, which were found to be only lightly affected [Hosking and Kershaw, 1985]. Underneath these a profusion of juvenile red and silver beeches and other species are present. Such a mixed beech forest structure suggests a certain 'in-built forest resilience' as well as a lengthy period of time between catastrophic events, thus enabling a mixed aged and species structure to develop. While the evidence for such a pattern being widespread or usual is inconclusive Hosking and Kershaw's research seems to indicate (at least in this instance) that when large-scale collapse does occur it affects mainly a single age class and/or a single species.

This is not to say that the two disturbance theories are mutually exclusive. It is likely that both interpretations are actually occurring concurrently, one on a shorter time scale and the other on a longer one [Benecke, *pers com*]. However, if large scale forest collapse does occur in the mixed beech forest, and it clearly does from the Maruia Valley example, it appears to be a rare event affecting mainly only the old-growth trees. The next generation of trees thus remain and continue the cycle. To use this as ones model for mimicking the disturbance dynamics of a mixed beech forest and create large coupes reflecting total catastrophe would err on the side of recklessness. Mr Topping's understanding of the dynamic is related to the small disturbance theory. He feels that it is safer to take this approach as any misinterpretation of what is happening can be more easily remedied.

While it is perhaps a rare event for the scale insect *I. fagi* to undergo a population explosion, as happened in the Maruia Valley in the late 1970's, it is more common for the pinhole borers of the *Platypus* genus to do so[3]. Generally the existence of *Platypus* species in the beech forest has minimal effect on the ecosystem. At the individual tree level there is evidence that the presence of *Platypus* in the sapwood reduces leaf growth and, in turn, affects the growth of the infected tree. Their

[3] *Platypus apicalis, P. caviceps* and *P. gracilis*

handiwork also creates a "defect" in the wood and allows for the passage of pathogens which may cause wood rot [Milligan, 1974].

Occasionally, however, their effect is at the forest or stand level rather than the individual tree level leading to a greater affect on the forest ecosystem. A relatively minor event such as windthrow, slip or snow damage may lead to a build up of the insect population in the damaged or dead trees, which can then explode and enter the less resilient trees in the surrounding stands. The newly infected trees are then unable to tolerate such an attack and die themselves.

This phenomenon has been seen to be a major problem for the development of forestry in the beech and mixed beech forest and has served to limit its potential. Forestry, through roading and harvesting, can create similar disturbances to those which trigger natural population explosions of *Platypus*. This appears to have been more of a problem in the days of large scale clearfelling where considerable volumes of wood debris was left behind; debris which provided suitable conditions for the build up of these insects. This often resulted in dieback in parts of the surrounding forest. Today, with the development of low impact harvesting methods and techniques to render wood debris unfavourable to *Platypus*, combined with less waste material through improved utilisation of wood, this problem should be seen as less of a hinderance to the future development of the industry[4].

Another insect which is an important part of the ecology of these forests and has implications for their management is the scale insect *Ultracoelostoma assimile*. *U.assimile* lives for much of its life in cavities just below the bark of most beech species and feeds on the sap of it hosts. It exudes a sweet carbohydrate as waste. This waste, or honeydew, forms an important food source in the mixed beech and

[4] From a forest managers point of view it is also interesting to note that the faster the tree has grown the more susceptible it is to attack by pin hole borer (Topping, *pers comm*). It has also been observed that red beech in the range of 20cm - 30cm d.b.h is particularly susceptible to pinhole infestation (Topping, *pers comm*). Contrary to conventional wisdom (Gadgil *et al*, 1995) Mr Topping has found hard beech to be hardly ever affected by pinhole attack at all (*Topping, pers comm*).

beech forest for a range of nectar feeding birds and other organisms as well as forming the basis for the beech honeydew industry. *U.assimile* is rarely found on silver beech.

5.3 History of Glenhope

One of the first people to settle in Glenhope Valley was Thomas Newton McConochie and his family. They arrived in the area towards the end of last century and immediately began clearing the easier land of forest and converting it to pasture. After the First World War, nearby Lamb and Cow Valleys were also opened up as rehabilitation blocks for returning soldiers. Much of the forest on the valley floors was felled. Three sawmills operated in the Glenhope area milling mainly rimu and matai with smaller amounts of kahikatea and silver pine. Some beech was also milled to supply railway sleepers for the railway which was being pushed through from Nelson. By the 1940's the sawmills had all closed; a function both of the beginning of World War II and the subsequent shortage of labour, and the exhaustion of the easily accessible supplies of podocarp species.

The rehabilitation blocks proved to be uneconomic and were later combined to form larger economic units. Two of these were leased for farming by Newton McConochie and his brother; descendants of the original inhabitants. Up until the late 1970's only a rough clay track connected Lamb and Cow Valleys. This presented problems for stock movement and other farm operations. Between 1977 and 1981 a road was formed, over the ridge between the two valleys, using funds from the sale of trees on either side of the road to meet the $70,000 required for the cost of its construction. The forest was clearfelled between 50 and 200 metres from the roadside using industrial logging techniques and sent to the Nelson Chip Mill for export as wood chips.

Peter Topping arrived in Glenhope towards the end of 1978 in time to see the last truck loads of logs on their way to the chipmill. Coming from a sawmilling

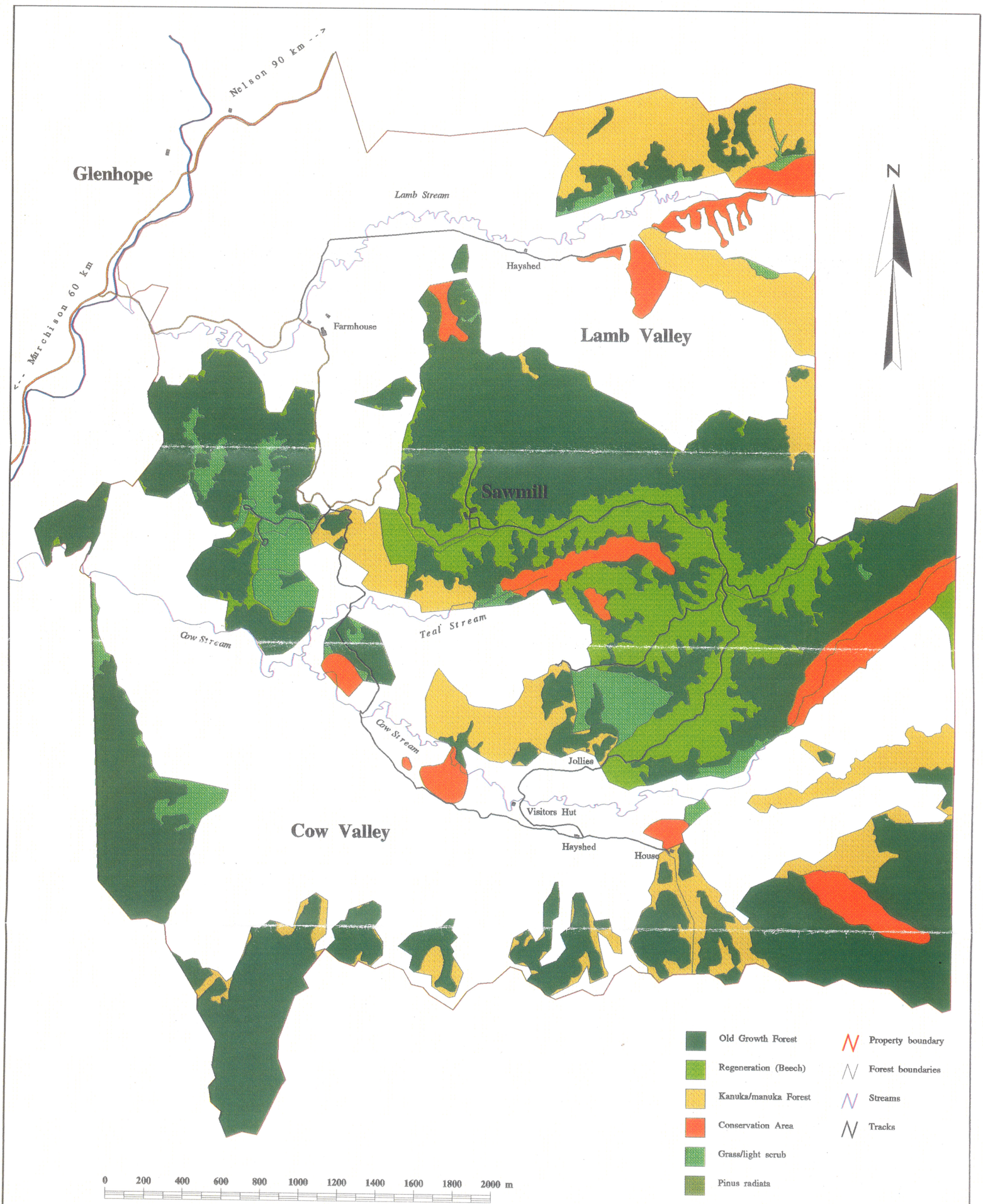
background in Australia he saw the potential for a more sustainable operation for the remainder of the forest. Fortunately a substantial amount of forest remained and the cutover forest was not burnt. Consequently seedlings readily regenerated in the cutover. Other areas on the family farm which surrounds the forest are also regenerating back into beech and kanuka. This process is being actively encouraged with an ongoing fencing programme, particularly where the land has minimal potential for grazing. This is having the dual affect of increasing the size of the forest cover over the whole property as well as providing for more options for forestry[5] in the future. Up until 1991 the forestland was leased from the Crown and royalties were paid on the timber extracted. Today, however, the property is freehold.

5.4 Introduction to Glenhope Native Forest

Glenhope Native Forest (also called Glenhope Native Timbers) is 90 kilometres south east of Nelson and owned by a family by the name of Pettigrew. The forest is located for the most part on a leading east-west ridge between Lamb and Cow Valleys. The valleys are lightly wooded but mainly in pasture and operated as a sheep and cattle farm. The 884 hectare forest has been managed by Mr Peter Topping for the last seventeen years for the purpose of supplying primarily native beech sawn-timber to customers mainly in the Nelson region (Figure 7 for map).

The forest can be described as a mixed beech/ hardwood/ podocarp forest. Red and Silver beech make up approximately 80% of the timber species over the whole property with hard and black beech being locally dominant on favoured sites (See Figure 8 for proportion land in forest types). Silver beech are spread relatively evenly throughout the forest weaving their way up through the canopy where they can, though rarely do they reach upper canopy status. Scatterings of mature rimu are present on the sunny, sheltered and well-drained slopes though pole stands

[5] The term forestry here is used in its widest sense which includes agroforestry, as well as usufruct products, "minor products" and protection forestry (or non-utilisation).



Glenhope Native Forest

Complied by Dean Walker,
Centre for Resource Management,
Lincoln University.
16 February 1996.

are rare. Occasional kahikatea are, and in earlier times matai and silver pine were, found on the easier poorly drained slopes [Topping *pers com*]. There is also a considerable area of kanuka forest (around 150 hectares within the forest boundary and another 150 hectares on the farmland) which colonised some low fertility areas after burning. Mr Topping is beginning to manage the kanuka forest both for small dimension timber and firewood. (See Figure 9 for plot data).

Forest Type	**Area (ha)**	**Percent**
Old-growth (beech/podocarp/hardwood)	505	57.1
Conservation (Various species)	46.5 (21.5)*	5.3
Regeneration (Mainly beech < 17 yrs)	71	8.0
Grass (+ sparse regeneration)	110	12.4
Kanuka and manuka	150	17.0
Radiata Pine	1.5	0.2
TOTAL	**884**	**100**

Figure 8. Area and percentage of Glenhope Native Forest in various vegetation types. * 21.5 hectares of the land being managed for conservation purposes lays outside of the forest boundary, ie is found on the surrounding farmland

Species	**Percent**
Silver Beech	35
Red Beech	44
Hard Beech	7
Black Beech	13
Rimu	>1
Kahikatea	>1
Totara	>1
TOTAL	100

Figure 9. Relative proportion of tree species in old-growth forest within Glenhope Native Forest. Preliminary results from 58 plots measured.

Immediately previous to Mr Topping taking over management of the forest in the late 1970's a substantial area of the forest had been clearfelled. Most of this area has now regenerated back into mixed beech forest; some reaching over 13 metres in height. Much of the work during the earlier years of management involved Mr Topping cleaning up the considerable damage which had been caused by the clearfelling operation; particularly to the edge of the forest which had been left standing. Many of the trees being taken out were salvage trees. In the early 1990's he introduced a small group selection system into the forest and began to harvest some of the old-growth forest. He has also carried out pruning and thinning in the regenerating forest.

A philosophy of what sustainability and indigenous forestry is or should be about for Mr Topping and the Bettigrews has developed over the years while living and working within the forest. Transforming this philosophy into reality has required the development of certain silvicultural systems, schedules and practices. The conventional silvicultural systems practised in New Zealand proved to be of little help or inspiration to Mr Topping as they virtually single-mindedly focused on single species plantation systems. While similarities may be found within European near natural management systems Mr Topping has had to develop his own system of indigenous forest management techniques designed to suit his own set of needs, local conditions and opportunities within the forest.

Mr Topping has three guiding principles which help to direct his activities in and relationship with his forest. The first, and over-riding principle, is the **maintenance of old-growth** forest. While he is trying to maintain a representative range of all stages of forest growth, the emphasis is placed on perpetuating old-growth forest. He views the old-growth forest as the most important ecologically, containing the highest species diversity, providing the greatest range of economic opportunities and containing the highest quality forest products.

His second guiding principle is the **minimisation of the volume of both**

outputs from and inputs into his forest. This principle is tied to the first in that by minimising output, or continuingly trying to find ways of cutting **less** forest, one can almost not help but to maintain the old-growth forest. He has set a maximum volume that he will ever cut in any one year of 80% of the forest's annual volume increment (or annual forest growth) and has an expressed objective of operating below this level. The minimisation of inputs refers to both energy inputs[6] and financial inputs; both of which he is trying to reduce. The cost of development or maintenance, is seen by Mr Topping as a cost not only to himself but also to the forest. Any increase in inputs must ultimately be paid for from an increase in products extracted from the forest, not withstanding increases in the value of the products obtained from the forest or better utilisation of these same products. Mr Topping feels that any development, if paid for from an increase in the output of the forest in the short term, must be justified on the basis of reduced input in the long term.

The third principle, which is also tied to the maintenance of old-growth forest as well as the minimisation of outputs, is to **maximise utilisation** of those forest products which are removed from the forest. The main rationale for this principle is, to make better use of the forest products so as to reduce the need to remove present volumes while receiving the same or better returns. Maximising utilisation is a feature of conventional industrial forestry. However, the difference with Mr Topping's approach is that he is trying to apply this principle throughout the whole forest not only to that which is generally considered to be the marketable part of a forest. He is developing a **range** of markets for **many** parts of his forest and its products as well as many parts of the trees within the forest.

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[6] Essentially fossil fuels.

5.5 Analysis

These three principles, that of maintenance of old-growth forest, minimisation of both outputs and inputs, and maximisation of utilisation combine together to form a philosophical framework from which Peter Topping can base decisions regarding his forest. It appears that his philosophy and practice take into account the economic, biophysical and social dimensions of sustainability. However, are these being successfully integrated? This section follows Mr Topping's efforts on his path to sustainability? The reconceptualised model of sustainability is used as a framework to examine Mr Topping's operation from a number of perspectives.

5.5.1 Economic/ Biophysical Dimension

When most foresters think about sustainability they invariably have in mind the "(m)*anagement of the forest to provide a sustained yield of timber*" [FAO, 1993, p10]. This is not surprising as sustained yield is the principle basis of the forestry discipline and according to Studholme it has been so for as long as forests have been actively managed [Studholme in Ralston, 1994]. It can be traced in the Western tradition, at least as far back as the French Forest Ordinance of 1669 [FAO, 1993]. The Forest Amendment Act, 1993 also focuses on sustained yield though not explicitly[7]. Similarly the Ministry of Forestry in its requirement for sustainable forest management plans under this Act focuses its requirements on sustained yield. It seems appropriate that any examination of sustainability in terms of indigenous forest management should, therefore, begin here.

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[7] This conclusion is reached as the purpose of the Forest Amendment Act is "*to promote the sustainable forest management of indigenous forest land*" [FAA, 1993, p5] and the definition of 'sustainable forest management is *the management of an area of indigenous forest land in a way that maintains the ability of the forest growing on that land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values*" [FAA, 1993, p4]. If the intention of the Act was to encompass a wider meaning of sustainability (outside of sustained yield) it needed to made explicit reference to a wider range of values, ie social, biophysical and intrinsic values.

Sustained yield in terms of forestry can be defined as a forest area managed to produce roughly equal annual, or regular periodic, yields of timber or other forest products in perpetuity [Young, 1982]. A variety of silvicultural systems can be applied to manage and harvest timber as well as theoretically perpetuate the conditions for regeneration of the forest to meet this end. Sustained yield is based on a mathematical model of biological growth that assumes that at any given population level a surplus exists that can be harvested in perpetuity without altering the stock level [Clark, 1976]. In forestry the maximum sustainable yield is generally determined by the annual (or periodic) growth increment in that forest and is set as an upper limit for the amount of timber available for harvested in that year (or time period). This section explores the silvicultural system used by the forest manager in order to achieve the goal of sustainable yield.

Management system

In Glenhope Native Forest the silvicultural management system used by Mr Topping can best be described as a type of small group selection method. In this system small groups of trees are harvested together, though occasionally single trees may also be extracted. This method is favoured by Mr Topping because he sees that this is the most ecologically appropriate way to perpetuate the existing uneven-age and mixed species nature of the forest. He has developed this management system to try and replicate the dynamics and phenomena of the natural forest.

Beech trees have a tendency to grow in cohorts with the individuals in a group of a similar age related to a common disturbance event [Wardle *pers comm*, Benecke *pers comm*, Hewitt *pers comm*, Topping *pers comm*]. The disturbance can be triggered by snow, wind, insect population explosions or other natural events [Wardle, 1984]. Forest ecologists refer to the results of these disturbances as natural gaps [Benecke *pers comm*]. Mr Topping prefers to call these groups of trees 'natural coupes' as he feels that natural gaps can only really be observed when all trees in that group have fallen to create that gap. A natural coupe can

be observed while the trees are still standing as a cohort. These natural coupes form the basis from which he selects trees for harvest (hence coupe). Generally in Glenhope Forest these natural coupes tend to be between .025 and .05 of a hectare[8] in size and contain around four and occasionally up to eight mature trees in number. His system of management attempts to mimic both the natural gap phenomena and the dynamic of forest disturbance; the harvest being treated as a disturbance event, albeit a human induced and controlled one.

The groups of trees selected for harvest are based on observation of the health and stage of life of the natural coupes. At present most of the groups selected for harvest are old and deteriorating or whose death is perceived to be imminent in the short-term. Healthy mature stands are generally left as long as possible, until they start to show signs of deterioration, before being harvested. Mr Topping plans to increase the range of age classes harvested in any one year rather than concentrating on the oldest trees. This way Mr Topping sees that old-growth coupes will always be present in the forest. The flora and fauna which depend on this forest type should likewise be perpetuated as should the character woods which the old-growth forest tends to provide in abundance.

The size and shape of a coupe is not based on any pre-determined formula or pattern rather it is based on the configuration and numbers of trees within individual natural coupes. Their shape is also determined by the site on which they are growing. For example coupes near the skyline or on exposed sites are shaped parallel to the predominant wind rather than across it so as to help protect the trees on the edge of the coupe from wind damage. From Mr Topping's experience it was found that trees on the edge of coupes shaped at right angles to the predominant wind suffered unacceptable wind damage. He now takes into consideration the predominant wind direction when deciding on coupe shape.

Mr Topping's forest management was not always as it is now. His coupe size was

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[8] The maximum coupe size allowed by the Forest Amendment Act 1993, as of right, is .5 of a hectare.

larger; occasionally being up to .3 of a hectare. Each coupe was clearfelled with all trees being removed regardless of their size, the structure of the coupe or the species within. However, over time he gradually began to dispense with this method. He started with a reduction in the size of the coupes being felled. This step was partly taken so as to reduce the visual impact of the harvesting operation. He also saw, from observation of natural coupes, that the coupes he was harvesting bore little relationship to the size and dynamics of the natural cohorts of trees and he was sometimes having problems getting regeneration. As well as reducing the size of his coupes[9] he also has dispensed with felling all trees within them; leaving as many poles and saplings as possible as advanced regeneration. These are left to continue as the next generations of crop trees.

Thinning and Pruning

The natural regeneration in the areas cutover in the late 1970's has been vigorous with areas of up to 25,000 sph being recorded; the exception being on the tracks and skid sites which have generally failed to regenerate. Most of his thinning and pruning has taken place in these areas, although he does carry out preemptive thinning in the old-growth forest around coupes subsequent to their harvest.

Mr Topping is not trying to speed the growth rates up greatly and achieve higher yields with his pruning and thinning as might be expected. The type of trees he prefers to mill, have the most sort after characteristics, sell the easiest and tend to have the highest ecological values[10] are the older trees. Mr Topping acknowledges that it is possible to grow merchantable trees in Glenhope Native Forest in 60 to 80 years. He has felled trees of this age himself. However, his

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[9] He now models his coupe size and structure on a natural coupe found within the forest which is approximately .05 of a hectare in size.

[10] Ecological values are those defined as those things that human beings value in Nature both for their utilitarian and non-utilitarian purposes. These include biological diversity, soil, water, air and landscape. Ecological values also include those intrinsic values in Nature which cannot be determined through human cognition but which Nature values for its own sake.

"perfect" tree is 120 years old and is slow-grown. He is not aiming to achieve faster growth but more even growth. Whilst conforming to a general S-shaped curve growth pattern, under natural conditions trees have a tendency to grow unevenly with periods of faster growth being related to light competition and periods of slower growth related to heavy competition. Such growth patterns create difficulties in milling and can cause warping and cupping during seasoning [Topping, *pers com*].

When selecting for form during thinning it does not necessarily mean that Mr Topping is looking for all clean straight butts. Unusual and interesting forms, such as warped, bent or double leaders, are as important to him as the straight forms. Apart from simply enjoying such forms and variety in his forest, Mr Topping believes that they will ultimately help to produce the character and special purpose woods which people are increasingly wanting from the old-growth forest. He is finding, for example that customers are prepared to pay much more for bent or curved flitches than for straight ones.

Mr Topping has experimented with several thinning "schedules" over the years. The word schedule has been placed in quotation marks here because although there are generalisations which one could make about things that have been done in each of the stands one could hardly say that "this is the rule" or the formula for what he does. The exceptions are almost as common as the rule itself. One generalisation that could be made is that he has been shifting from heavy to lighter thinning.

With regeneration densities of around 25,000 sph at year 10 - 12, his first schedules involved thinning saplings to approximately 1000 sph. He found that the trees responded by tending to crown or "blow out" in the tops and take on a stunted form. Winter desiccation was also a problem leading to further reductions in densities. Patches of bracken fern developed and even today many of these areas are devoid of tree species.

He then tried thinning to approximately 2000 sph and obtained similar results to the first with early crown formation, though less winter desiccation and invasion by bracken fern. His most recent trials involve a first thinning to an average of 5000 sph. This regime appears to prevent early crown formation and promote tall trees whilst reducing competition and alleviating the problems caused by winter desiccation. The figures given above for Mr Topping's three experimental thinning schedules are averages only and do not reflect the range of densities, the distribution (spacings) of stems over that regime or the species within them.

In the old-growth forest silver beech essentially occurs as a subcanopy tree under the other beech and podocarp species. In the thinning operation it is treated accordingly, so as to maintain this nature. Silver beech grows slower but is able to tolerate more shade than the other species [Topping *pers comm*, Wardle, 1984]. In the cutover, regenerating forest silver beech is generally observed as a thin (<5cm dbh) tree weaving its way up through much larger stems of the other species of beech. It rarely requires thinning or pruning as growing in conditions of low light levels tends to promote tall, thin trees with few branches. From his experience Mr Topping has also found that silver beech tends also not to respond to silvicultural treatment, particularly where it has started off life as a slow growing tree.

As with the thinning, there is no formula for pruning. Each tree is treated as an individual. However, there are some generalisations which have been noted. As already mentioned silver beech is rarely pruned as its ecology and growth form tends to lend itself to a lightly branched tree (except where it has grown in the open). With the other species of beech, variable lift pruning is applied with each tree being pruned to a height appropriate to its form and diameter. The trees which are deemed to be part of the final crop are pruned to a higher height than those where the intention is to remove them in a production thin. In fact, often the intended production thinnings are not pruned at all, especially on the edge of the forest where they serve to act as shelter and protect the final crop trees from wind. The potential danger here, however, is that the unprunned trees may grow

faster than the pruned ones and tend to suppress them.

Yields

While some may criticise Mr Toppings management system over its time-efficiency and logistics - objections often levelled against the small group selection system according to Young [1982] - these small coupes often yield surprisingly high volumes. The volume of standing timber per hectare over the old-growth forest is in the range of 240-270m3. It is, however, possible to harvest between 15 and 20m3 from a single .025 hectare coupe (or between 600 and 800m3 for every hectare felled[11]). It must also be remembered that in this system, in theory, the forest coupes are harvested at shorter intervals than the length of time it takes to grow a tree from a seedling. For example, in the future 120 year old trees may be harvested from a coupe which was previously harvested only 80 or 90 years beforehand due to poles being left as advanced regeneration during the original harvest.

Mr Topping appears to be operating a policy of caution in terms of the volume of timber he is harvesting from his forest[12]. The mean annual volume increment in the old-growth forest is probably in the region of 5 - 8m3/ha/yr with a tendency towards the upper limit [Tinley, MoF, *pers comm*]. Glenhope Native Forest is 884 hectares in size of which 505 hectares is old-growth forest available for harvest, therefore, the biological maximum sustainable yield of this portion of the forest (assuming an m.a.i of 6.5m3/ha/yr) is 5746m3/yr. However, Mr Topping has an explicit policy of harvesting no more than 80% of the forest's annual growth (or maximum sustainable yield) in any one year. He feels that this should account for any errors in his calculations as well as help ensure the future provision of old-

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[11] An interesting comparison is that the maximum yields *Pinus Radiata* can produce is between 500 and 800 m3/ha on the better sites in New Zealand [Millar, 1995], however, this is usually achieved within a shorter time frame and over smaller areas.

[12] Under the Forest Amendment Act 1993 forest owners are generally restricted to harvesting the equivalent to the annual volume increment over their forest (not including areas reserved for conservation purposes).

growth trees. The maximum volume which will ever be harvested (including salvage timber) in any single year is, therefore, 4597 m3/yr. At present he is harvesting between 300 and 400 m3/yr. This is below 10% of the annual volume increment of the old-growth forest. In other words, he should theoretically be able to log at least ten times as much as at present and still be below both the biological sustained yield as well as his own maximum sustained yield.

From the data above it appears that Mr Topping does have the potential to increase production, however, he is not enthusiastic about doing so and changing his scale of operation. While an increase in production would probably result in an increase in income it would also mean an increase in costs (as well as more work for himself). He feels that any increase in costs are seen as costs not only to himself but also to the forest. Mr Topping feels that any increase in production must be justified on the basis of reduced input (in terms of energy and resources) in the long term. He also feels that by operating at a level somewhat below that of his annual forest increment it should ensure that the forest should continue to supply him with a sustained yield of timber even if there are errors in his calculations or management system.

5.5.2 Biophysical Dimension

Ecologists and environmentalists often argue that biophysical sustainability[13] should take precedence over other forms of sustainability [Stewart, *pers comm*]. They believe that the maintenance of genetic, species and ecosystem diversity from which resources for human needs are derived must be given priority if our utilisation of these resources is to continue and in turn lead to sustainable societies and a sustainable planet [Peet, 1992]. Biophysical sustainability not only involves the maintenance of biological diversity but also the maintenance of those biophysical factors which make biological diversity possible [Barbier, 1987;

[13] Biophysical sustainability is also called biological or ecological sustainability.

Vaughan, 1993; Barbier *et al*, 1994; Hammond, 1995] .

For purposes of this discussion the biophysical dimension of sustainability is divided into two parts for evaluation; these being biological diversity and, soil and water (as important biophysical functions). It is acknowledged that these are in reality inseparable, as each gives the other meaning and neither can exist without the other, however these general categories have been created for convenience of inquiry.

5.5.2.1 Sustaining Biodiversity

Biological diversity (or biodiversity) has been defined as the variety of life on earth encompassing three main levels of organisation: *genetic diversity*; the total range of genetic information contained in the genes of all living things, *species diversity*; the variety of species of organisms on earth, and *ecosystem diversity*; the variety of habitats, biotic communities, and ecological processes and interactions that characterise the biosphere [Groombridge, 1992].

As suggested by Holling [in Barbier, 1989] the maintenance of ecosystem diversity is conditional on the maintenance of ecosystem *productivity* (in terms of numbers and biomass of individual species), *stability* (as "the ability of a system to maintain a relatively constant condition in terms of its species composition, biomass and productivity, with minor fluctuations around a mean value (the equilibrium point)") and *resilience* (as "the ability of a system to maintain its structure and patterns of behaviour in the face of disturbance"). Thus the maintenance of biodiversity is a multi-faceted project on a number of levels.

According to Groombridge [1992] a commonly held view is that the application of economic mechanisms to natural resources necessarily leads to substantial losses of biological diversity. Our utilitarian motivations and anthropocentric values tend to give higher value to some things and less to others. This generally leads to

practices which reduce those things which have less value to us and consequently lead to a reduction in biodiversity [Robinson, 1993]. Such a criticism is often levelled at forest management systems, even those systems which involve indigenous forests and are purportedly sustainable [Maser, 1994; Pearce and Moran, 1994].

The propensity of forest management systems to reduce old-growth forests perpetuates this perception. The principle structural feature of old-growth forests is their old large trees; some trees will have reached the end of their lives and are dead or dying. Spars may be standing dead, leafless and disintegrating or they may have fallen over, and be covered in lichens, moss or seedlings. Trees of old-growth forests often have broken branches and contain rot or other pathological wood as a result of the presence of insects or disease. These features of the old-growth forest are seen to be negative within the Modernist project called forestry. Such forests are called 'over mature' and 'abnormal' (as opposed to normal) indicating the forestry discipline's aversion to them [Shiva, 1993; Maser, 1994].

As a result most silvicultural management systems manipulate forests with an uneven-age structure made up of a mixture of both merchantable and non-merchantable species to a forest where merchantable species and even-aged stands predominate [Maser, 1994]. Even where uneven-aged management systems are specified certain species are favoured over others generally leading to a change in species composition over time [Booth, 1992]. Such systems also attempt to decrease the amount of "defect" wood in the forest, increasing the growth rate of the forest and making way for the more financially economic second growth [Maser in Wray, 1988]. Managed forests rarely, if ever, support the species richness and biological diversity which is often found in old-growth forests, in fact their methods actively serve to reduce diversity [Booth, 1992; Maser, 1994]. This is not to claim that managed forests are 'biological deserts', in fact, even exotic plantations often support native species [Allen *et al*, 1995; O'Loughlin, 1995; Spellerberg and Sawyer, 1995].

Within the Modernist project Nature and biological diversity tend to be cared for within reserves (or probably more accurately preserves) to which no active management is applied. This 'solution' has had a number of consequences; the most unfortunate of these is that it can act as a 'sort of trade off and serve to legitimise, not simply the use of Nature, but the exploitation and abuse of Nature outside of these reserves. This may in turn impact back upon the reserved areas (see *5.6 Comparison of Other Forest Land Uses in the Glenhope Area*). Stengs [in Henriques, 1991] in his analysis of development and preservation on the West Coast of New Zealand has observed that such a split can also work the other way. It can limit the opportunities for the use of Nature, even use which respects Nature such as that which involves low impact techniques and methods, because Nature is seen either to be exploited or preserved; not both. Another flaw in the practice of reserving particular areas of Nature for the preservation of biological diversity is that these reserved areas often tend not to be representative of or contain 'complete' ecosystems. Whole functioning ecosystems are required to be conserved if one is to truly maintain biodiversity.

A recent proposal by Timberlands West Coast Ltd lends credence to the criticism of those who maintain that indigenous forestry, even that which claims to be sustainable, is detrimental to biodiversity. Within its management plan there are intentions to change areas of their old-growth beech/podocarp forest to monospecific beech forest and operate short rotations. Timberlands maintain that biodiversity amongst tree species is protected within nearby Department of Conservation reserves. While the Department of Conservation does have reserves at lower altitudes and work has been done on securing a greater representation the majority of their lands are located at higher altitudes than the forests under the control of Timberlands. Moreover, the action of Timberlands serves to disadvantage private forest owners who, under the Forest Amendment Act 1993, are required to set aside up to 20% of their forest in reserves. Timberland's rationale appears to be typical of the Modernist approach to the protection of biodiversity as is the outcome.

5.5.2.2 Forest Management

As has been discussed the Modernist forestry paradigm is often criticised because its goals are also seen to be singularly utilitarian in intent. Such a reductionist focus is seen by some as being in direct conflict with the protection of biodiversity. [Shiva, 1993; Maser, 1994; Rosoman, 1994]. However, at Glenhope Native Forest it appears that the forest management system is actually aimed at sustaining, and even enhancing, biodiversity. This is not done by preserving some areas at the expense of other areas, as is often the 'solution' within the Modernist project but the emphasis at Glenhope Native Forest is on the maintenance of biodiversity throughout the **whole** forest, not merely in parts of it.

Mr Topping appears to be carrying this principle out at the three levels of biological diversity; that is at the ecosystem, species and genetic levels. His methods of forest management which enable him to meet these ends are briefly outlined below. Following on from how he seeks to maintain biodiversity throughout the whole forest his rationales for doing this are discussed. His reasons for protecting biodiversity are both utilitarian and non-anthropocentric.

In order to protect biological diversity and other ecological values at the **ecosystem level** Mr Topping is attempting to understand the natural system and mimic the processes, dynamics and time scales within the forest. As previously mentioned his selection and treatment of the coupes for harvesting is based on the observation of forest dynamics; particularly the phenomenon of cohorts or 'natural coupes' and the processes occurring within them. Within the coupes, as with the rest of the forest, an uneven-aged forest structure is the usual pattern which is aimed for in the forest management.

It is often argued that a managed natural forest may actually increase the biological diversity of a forest ecosystem [Benecke, *pers comm*; Wardle *pers comm*; Maser, 1994; Walsh, 1995]. The various age classes present in a managed natural forest present a range of habitats and conditions suitable for different species of

birds, plants and insects. For example, previous to the clearcut the occurrence of bush lawyer was relatively rare. Today the particularly high occurrence of bush lawyer in the cut over stands in comparison to the mature stands has probably had consequential 'benefits' to the forest community, particularly as a food source for fruit eating bird species such as the kereru, silvereye and kaka. Wardle [1984] noted that the ability of a stand to withstand a particular disaster, ie snow, wind or insect population explosion, is a function of the characteristics of that stand, ie species and age amongst other things. Mr Topping's forest management system with a mosaic of stands throughout the forest should not only enhance biodiversity but should, if Wardle's observation holds, also increase the overall resilience of the forest to withstand large scale disasters.

Mr Topping acknowledges that through silvicultural management he could increase the overall growth rate of Glenhope Native Forest. He has harvested individual red beech trees which have had perfect growing conditions and have attained diameters usually associated with trees of 120 years age in only 80 years. He is, however, concentrating on trying to manage his forest as an old-growth forest. While only a relatively small proportion of trees will be managed to reach full maturity[14] it is planned that none will be harvested which have not reach what Mr Topping identifies as the 'mature' stage[15].

The total number of species or floristic composition of Glenhope Native Forest is not consciously being reduced or simplified by Mr Topping, as is accused of Modernist forestry [after Booth, 1992; Shiva, 1993; Maser, 1994; Rosoman, 1994]. Rimu, and the other podocarps which exist as occasional emergents in the forest,

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[14] Mature trees are defined as final 'crop' trees which are in an 'over mature' state; that is they are beginning to reach the end of their lives. The age of these trees varies considerably depending on species, location and growing conditions but is probably in the range of between 300 to 500 years [Topping, *pers com*].

[15] Whether a tree is defined as 'juvenile' or 'mature' by Mr Topping tends not to be a direct function of age. For example, a 'juvenile' red beech is recognised by its smooth, light coloured bark. 'Mature' red beech has a rough bark which is darker in colour. The difference between 'juvenile' and 'mature' tends to be more a function of rate of growth and location. However, 100 years is probably a rough minimum age for a 'mature' red beech [Topping, *pers com*].

as well as the understorey species of hardwoods, ferns, and the predominant four species of beech are **all** being managed through protection and encouragement. Mr Topping has essentially a no harvest policy on his podocarp species. The scarcity of them in the forest and their relative importance in the forest ecosystem [Clark, 1995] as well as the lengthy period of growth to maturity[16] necessitates this in order to continue their relative presence. Any inclusion in a harvesting programme could lead to substantial changes in the forest ecosystem. Therefore, Mr Topping's policy is to only harvest salvage podocarps or those podocarps where their removal is essential such as where they interfere with forest operations such as track construction. Podocarp seedlings and saplings are treated with particular reverence and are always protected during harvest and other forest operations.

The smaller species of hardwoods and ferns are similarly valued, even though their value may not be potentially or foreseeably economic. Mr Topping is not actively trying to change his forest to a podocarp forest, however, his actions suggest that special effort is being placed on the continuation of podocarp species at least at the present level because of their relative importance both to the forest ecosystem and to his own intellectual needs.

Mr Topping is attempting to manage this forest as an old-growth forest. This is primarily for its ecological values such as biodiversity. A small population of kaka[17] reside for at least part of the year at Glenhope Native Forest. It is one of many species which is dependant on this type of forest; without the mixed species old-growth forest they are not present [O'Donnell and Dilks, 1987]. The podocarps produce fruit which forms part of the seasonal diet of the kaka and in turn forms part of the rationale for including them in a harvesting plan. Dead and dying standing trees and spars are also left where possible to act as what Mr Topping terms "habitat trees". These contain grubs and insects which kaka also need as part of their diet.

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[16] Between 300 and 600 years to maturity depending on the species and site (Hinds and Reid, 1957).

[17] The kaka is locally known as the koko (pronounced core core).

Traditionally foresters have viewed dead standing trees as a hazard, both to people and to other trees in the forest. The usual practice has been to cut these down to remove the perceived danger and "tidy up" the forest. Mr Topping prefers not to remove the old standing trees unless they pose a very real threat to personnel working in the forest or will cause imminent and substantial damage to remaining live trees. Generally damage to other trees is not such a problem in Glenhope Native Forest as they tend to rot and crumble down rather than blow over. Mr Topping wants to preserve these facets of his forest, not only for the kaka and other birds, the plants, the fungi, and the insects which require this type of forest for their survival but also for his own aesethic and intellectual needs.

The bushman who has been employed to help with the harvesting, has former experience with planting, thinning and pruning in plantation forests. He, therefore, has an understanding of the whole life cycle of trees, from seedlings and saplings (as he has grown and tended them) to senescence (when he has felled them). Unlike many specialist bushmen whose concerns tend to focus on the felling and removal of logs Simon has a unique appreciation of trees outside of the stage at which they are of merchantable size [Topping, *pers comm*]. When felling a tree his primary concern is for the succeeding generations of trees and their need for protection. He is paid not on the volume of timber removed but on a daily rate. The time taken to determine how the coupe is to be felled does not impinge on his wages and, therefore, he can afford to take his time. It can take Mr Topping and Simon up to half a day to simply decide how best to fell a coupe [Topping, *pers comm*].

As well as an understanding of the forest ecosystem, Mr Topping argues, that a respect for it is necessary for the maintenance of biodiversity. Coupes are felled so as to cause minimum damage to trees on the edge of the coupe. Broken branches and bark can allow the entry of *Platypus* or rot and cause dieback in affected trees. The nature of felling, however, makes some damage inevitable. Care is taken to avoid damaging saplings and poles within the coupe being felled with particular care given to the more mature poles and podocarp species. Some

saplings may be bent over out of the way or otherwise protected while the trees are felled. Seedlings and saplings are stood up and cleared around in the clean up operations. Also at this stage slash is cut up into short lengths (c 30cm long) to speed up their drying and make them less susceptible to *Platypus*.

At the **species level** of biodiversity protection, Mr Topping is trying to maintain the present range of species regardless of whether or not they have a present economic value. Taking kanuka as one example, the tendency has been for Modernist forestry to reduce the occurrence of this species and its associated ecosystem. It has only been in recent times that kanuka has legally been recognised as indigenous forest [Parliamentary Commissioner for the Environment, 1994]. The species continues to be furnished with the overtly value-laden terms "scrub" and "weed". As a result of this attitude its removal in favour of plantation species or grass has been predominant.

Mr Topping, in contrast, respects kanuka as a legitimate forest type and is beginning to manage it as such[18]. While the market for kanuka is still mainly as solid fuel he is managing the species as a timber tree with the thinnings being sold for firewood. Kanuka has been utilised in the past as a small dimension timber, however, partly as a result of a decline in readily accessible supplies of larger dimension logs, its popularity as a timber has waned [Clifton, 1990]. Kanuka is hard and strong and Mr Topping has found that the timber mills cleanly if with a little difficulty. With suitable marketing Mr Topping is confident

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[18] Kanuka has been utilised in the past as a small dimension timber because of its high density and strength. (see Footnote 29 page 166 for its properties). Although the diameter of kanuka at maturity is generally modest, at around 20cm dbh, it can attain a diameter of 60cm (Clifton, 1990). The volume of kanuka per hectare can also be surprisingly high, especially through the use of silviculture. Allen *et al* (1992) suggest a management regime for growing firewood of thinning the natural regeneration to 40,000 sph previous to canopy closure and 10,000 sph following canopy closure. Mr Topping is adapting such a firewood regime to a regime with the purpose of growing kanuka as a timber. This includes the gradual removal of trees to reduce competition and encourage diameter growth rate. From data obtained from Allen *et al*, it should be possible to grow a timber tree of 45cm basal diameter in around 60 years; the thinnings being sold for firewood to pay for the silviculture. Initial trials at Glenhope have shown that the timber mills well, though, their response to silviculture has yet to be monitored.

that he will have no problem in selling it as timber in the future.

Mr Topping is also beginning to manage the non-timber species, such as the small hardwoods and ferns, as an integral part of the whole forest ecosystem. They rarely interfere with his operation and so it makes no sense to Mr Topping to remove them. For a while the bush lawyer vine, *Rubus cissoides* was an exception. Not only did its presence make it difficult for workers to move through the forest but in winter it held snow and caused trees on which it was growing to be smothered or bent over. For this reason he removed the vine wherever he could. Recently, however, he has changed his view somewhat about the vine. He recognised that the bush lawyer appeared to act as a natural thinning agent in the forest. While it does smother some trees its does not smother them all. Mr Topping has observed that even where the bush lawyer is relatively thick a small number of more vigorous trees always manage to beat the vine. He uses this phenomenon to his advantage. In some situations he still cuts the bush lawyer but he does not do this as a matter of course; only where it is imperative. Even though he still removes a proportion of the bush lawyer it appears the effects of this practice are not unduly adverse. Despite his efforts Mr Topping believes that since the 1970's the relative occurrence of bush lawyer has increased as it seems to prefer the cutover forest. The conservation of bush lawyer also has benefits for fruit eating birds.

The protection of biodiversity in Glenhope Native Forest at the **genetic level** is also considered by Mr Topping. It is only the observable variations within a species (or phenotypes) which are able to be consciously protected. However, as phenotypes are frequently the result of an interplay between the genetically encoded information and the environment in which it is expressed [Singer and Berg, 1991], it is felt that genotypic variation can incidentally be protected. Mr Topping has found that if either a silver beech or red beech is amongst a group of hard beech they will tend to take on the timber characteristics (or throw to) the hard beech. One of the distinguishing characteristics of hard beech is that it has an interwoven or 'plaited' grain. Neither red beech or silver beech generally has

this trait - except when they are found growing amongst a group of hard beech[19]. Mr Topping's management system aims to perpetuate this phenomena. While Mr Topping does not express what he is trying to perpetuate in such a way (it comes more from what Wright [1992] would describe as a 'wild knowledge' understanding), in practice he is protecting the biodiversity at the genetic level.

Why is Mr Topping actively seeking to protect and maintain biodiversity within Glenhope Native Forest when the conventional wisdom would appear to suggest that this is not the most efficient approach. Mr Topping sees the maintenance of biodiversity as integral to the management of his forest. His resource base is at present mostly old-growth forest. He believes that not only does the continuation of old-growth forest make ecological logic but it also makes economic logic. In contrast, the Modernist forester often considers the old-growth forests to be negative in the sense that timber extracted from these forests is often of a poor quality [Ali Memon and Wilson, 1993]. However, Mr Topping feels that this view is dependent on how one defines quality.

He is finding that, for example, the type of wood which is in highest demand is that which is generally only found in the old-growth forest. A fast grown tree generally does not have the same character traits as those which are found in the older slow-grown trees. The colour in the wood of slow grown trees tends to be deeper, the ratio of heartwood to sapwood is higher and the growth rings are spaced more tightly than trees which have grown relatively fast. Similarly, the old-growth forest also supplies an abundance of character grade timbers such as fiddleback, birdseye, knotty wood, pinhole, burls, hollow wood, sapstain and curved flitches. These character timbers are steadily increasing both in popularity and price while at the same time the supply is dwindling. While it is probably safe to assume (like many other timber growers) that there will always be a market for fast-grown, knot-free, straight timber Mr Topping does not define his highest quality timbers in this way. His highest quality timbers are those which command

[19] Incidentally, Mr Topping puts this phenomena down to biochemical influences on one species by another.

the highest prices. Mr Topping is managing his forest in such a way so as to have a continuous supply of the diversity of products which his customers want and only this type of forest and forestry can provide in perpetuity.

Old-growth forests are also advantageous according to Mr Topping when it comes to processing. He sees the 'perfect' log for milling as one which is at least 120 years old and has grown slowly. Such a log contains less tension wood in it, remains stable when cutting and has less of a tendency to warp as it dries out [Topping, *pers comm*]. Contrary to the findings of Franklin [1995], Mr Topping has found fast grown beech to be a more difficult timber both to mill and to season. And contrary to Maser's [1988] claim of natural forest management, Mr Topping's system of forest management is not an attempt to decrease the amount of 'defect' wood in the forest, increasing the growth rate of the forest and making way for the "*more financially economic second growth*" [Maser in Wray, 1988, p55]. This is because the old-growth forest in the eyes of Mr Topping provides a perfectly adequate quality and a greater range of products than a forest operated under a system which favours even-aged stands and shorter rotations ever could.

While Mr Topping appears to practice what could be referred to as Postmodern form of biophysical sustainability, in that he is attempting to protect biodiversity through his whole forest, he is not entirely adverse to placing under protection special parts of Glenhope Native Forest. He sees that sometimes this type of measure is appropriate. Areas of reserve are required under the Forest Amendment Act, 1993 so he actually has a legal responsibility to do this anyway. A number of areas in Glenhope Native Forest have been recognised as having particular importance. As such, extraction of forest products from these areas will not take place. The worlds largest population of *Olearia polita* is found on the property as are the rare plants *Acaena emittens* and *Coprosma obconica*. These plants have been protected within areas which will not be utilised for timber because of their special importance, both to Glenhope Native Forest and to New Zealand. However, some active management may be required to maintain their presence.

The catchment area from where Mr Topping and his family get their water supply has also been set aside as a reserve from timber and other forest produce utilisation. The main reason for this move is to ensure that the water from the catchment remains clean and potable for his and his family's use. In the future Mr Topping and generations to come will use this area as a reference or datum point. In this area no intentional intervention of the natural processes will take place and thus there will always be a place where they can come and reflect and compare their impacts on the forest outside of this area with the processes of Nature. John Wardle [1984] also suggests that such "*preserved areas can act as base-lines for studying natural ecological processes, and in doing so help monitor changes consequent on man's occupation and use of land and its resources in other places*". If changes within the managed forests over time were seen to be unacceptable by future generations, modifications or complete changes to the management system could be made with greater rationale by having an example of the original forest as a reference. Wardle also sees that such areas can maintain reserves of genetic material which may be useful as points of dispersal if a catastrophe occurred in the managed forest which did not affect the 'unmanaged' forest [Wardle, *pers comm*].

Today little remains of the original flatland vegetation which was once widespread in both Lamb and Cow Valleys. The species which occupied these sites such as matai, kahikatea and yellow silver pine (*Dacrydium colensoi*) were favoured by the early sawmillers. These species are now restricted to the occasional tree on the property (Yellow silver pine was thought to be absent from the property but recently during a vegetation survey two trees were found). Mr Topping intends to fence the bogs and podocarp remnants on the flatland. In time these areas should regenerate themselves, perhaps with a little help from the Toppings and Pettigrews, to a resemblance of the original ecosystem. While fencing and regenerating these remnants will essentially create island reserves he sees that this will by no means preclude future generations from utilising the fruits of their efforts.

In summary, Mr Topping's essentially unconventional approach to the protection of biodiversity could be described as Postmodern in Nature. His approach is holistic rather than reductionist. While the Modernist forestry project has been denounced for actively reducing biodiversity [Shiva, 1993; Maser, 1994; Rosoman, 1994] Mr Topping's philosophy and management practices are not only are aimed at explicitly protecting biodiversity but it could also be argued that they may even be enhancing it.

While he is not changing the total number of species or species richness of the forest, Mr Topping's practices could theoretically be increasing the relative floristic diversity within the forest. Similarly Mr Topping's coupe felling regime and the creation of a number of different age classes within his forest could be seen as actively enhancing biodiversity through the creation of a more heterogenous forest structure [after Maser, 1994; Walsh, 1995].

Biodiversity is consciously protected in the whole forest, not just part of it. The preservation - exploitation split, which is so a much a part of the Modern world, is blurred. Mr Topping treats himself and his activity in the forest as part of the natural system; his respect for and dependency on the forest, and the basis on which he manages the forest, he believes, makes him little more of an intruder to the forest than the kaka which also obtains its needs from the forest.

Whilst environmental purists may accuse Mr Topping of being utilitarian and anthropocentric he believes that although he is making economic use of the forest and its products it is possible to protect and even enhance biodiversity within it. He manages Glenhope Native Forest not only for his own economic needs but for other values as well. He retains old dead trees throughout the forest as well as actively encouraging species which have no discernable economic value. While this practice may be construed to be for his own benefit, as he enjoys seeing these features in his forest, the main benefit is for other species such as kaka for whom these trees are crucial to their survival.

A criticism which could be made of Mr Topping's management system in relation to the maintenance of biodiversity is his lack of a monitoring system. Most of the environmental monitoring to date at Glenhope has been based on observation by Mr Topping and others working in the forest. If he perceives something to be 'wrong' he takes a course of action which he thinks is appropriate. An example of this can be found in his gradual reduction in the size of coupes felled based on his observation of natural cohorts or groupings of trees. This type of monitoring appears to have been appropriate in this instance. From this a holistic management system has evolved which takes account of the existing forest structure, natural cohorts of trees in the forest and landscape values.

Such observation and anecdotal evidence may also be useful in monitoring short-term trends in populations of prominent species, such as kaka, and even give some indication of possible causes of such trends. However, more focused and measurable monitoring systems are required if a long-term perspective is to be gained and species and variations outside of the easily observed are to be monitored. Part of what the Ministry of Forestry require in the management plans for Glenhope Native Forest (as well as other indigenous forests) under the Forest Amendment Act, 1993 is an ecological survey of the forest. This is a starting point, but unfortunately systems are not required to be put in place by the Ministry for monitoring the long-term effects of management on the ecology of the forest.

5.2.2.3 Soil and Water Conservation

The two main biophysical factors which have been singled out for discussion in this section are soil and water. Soil and water and their functions have been recognised in New Zealand, as vitally important entities to protect at least as long ago as the Soil Conservation and Rivers Control Act 1941, [McKelvey, 1995]. Without soil and water protected biodiversity and other ecological values are threatened, both on site and downstream.

Traditionally forest management practices concerning soil and water protection have focused on the creation of riparian strips alongside watercourses and the retention of forests on the steeper sites [Gilliam, 1992; McKelvey, 1995; O'Loughlin, 1995; Vaughan, 1993]. Essentially these features are linear reserves and have had similar outcomes for water and soil protection as have reserves set up for the protection of biodiversity; that is, they tend to protect the values within the reserve areas but not outside of them. Mr Topping's approach is to apply water and soil protection over his whole property, rather than to specific areas.

Roads, tracks and skid sites are recognised as having the greatest impact on soil disturbance and water quality within forestry operations [Gilliam, 1992]. Mr Topping is concentrating his efforts on protecting soil and water through minimising the impacts of these features. The present track system through Glenhope Native Forest was created during the industrial forestry phase of the 1970's. The two main concerns when forming these tracks were to connect Lamb Valley with Cow Valley and to remove the most easily accessible trees as quickly as possible. There was little concern for regeneration, water runoff, aesthetics or for trees which were left standing. Many logging tracks followed the crowns of ridges and spurs; most of which have left the ground bare, have failed to regenerate and are subject to continuing erosion. The lack of permanency in track construction appears to have encouraged a lack of care.

Mr Topping has decided to discontinue the use of most of these tracks with the exception of the main track connecting the two valleys. He is now in the process of putting in a new system of tracks; none of which follow ridge lines or spurs. This is not only because of risk of erosion and the visual impact which was created but ridges and spurs tend to be where the best trees grow [Topping, *pers comm*]. Where possible, the old ridgeline tracks are being replanted and regenerated.

In conventional forestry spur tracks are common and many of the non-arterial tracks are temporary [Robinson, 1995]. No new tracks at Glenhope Native Forest follow spurs and all are constructed as permanent. They are based on a contour

system following the contour of the land 100 metres or so down from the top of the main ridges and spurs. Even though the slope of the land is up to 35° the objective is to have no part of a track steeper than 8°. Mr Topping is also aiming at having no batter greater than 1.8 metres in height. It is felt that this type of track construction and system should help to minimise water runoff, visual impacts and soil disturbance. So far the new track network has not suffered the same effects of erosion as Mr Topping experienced with the former track system. He sees that this can be put down to the gentle gradients involved and the care with which the tracks are constructed.

Such a slope restriction invariably makes for a longer track system than that required for a ridge/spur network, however, there are benefits which are to be gained beyond the minimisation of impacts. This type of track system will enable access to a greater proportion of the forest than would do a ridge/spur network. Mr Topping has two Clydesdale horses which he has used to a limited extent for harvesting and the transportation of logs and timber. The slope restriction will make it possible to make greater use of his horses. It should also prove to be easier on the machinery and result in less breakdowns and maintenance than would be required on a steeper track system.

While tracks established for forestry generally have "water tables" or open drains to take water off of and to prevent water getting onto the track Mr Topping uses another unconventional roading technique to protect his water and soil conservation values. He prefers not to use side drains or "watertables" on his track network. He maintains that to have open drains entails a maintenance cost. To keep them working they must be cleaned out at regular intervals. But more importantly, open drains interfere with the natural water flows and drainage patterns. The concentration of water into channels gives water an increased capacity for scouring, which can lead to erosion and track washouts. He believes that interference with the drainage patterns may also impact upon the forest below the track adversely affecting plant growth. Individual trees may receive less or perhaps more water than they did so with the natural runoff previous to the

establishment of the track. His track construction, therefore, is designed in such as way as not to interfere with natural water flows and drainage patterns. Subsequently all new tracks are sloped gently out from the base of the batter to facilitate the removal of water off of them.

As mentioned, in addition to tracks, Gilliam [1992] cites skid sites as being a major source of sediment load into streams. Partly for this reason Mr Topping has begun to eliminate all skid sites except for the one at the mill. He is in the process of implementing a system by which all logs would be made in the coupes where they are felled and are then carted directly to the mill. The larger slash being cut into lengths for firewood and stored on the side of the track for later removal. Skids have not only begun to be eliminated for soil and water conservation reasons but also because they take up a considerable area which could otherwise be used for growing trees. Mr Topping also feels that it is best to keep ones "mess" in one place. This way he is inclined to keep the skid site at the mill tidy and if there are negative environmental effects from his activity he feels these and has to respond rather than operate a slash and burn mentality and move on from one skid to the next.

The choice of machinery, especially that used for harvesting, is another factor which Mr Topping feels is important when considering water and soil conservation values. Tracked or "walking" vehicles are preferred in favour of rubber wheeled vehicles even on relatively flat ground. They enable operations to be carried out in damp (but not wet) conditions and tend not to slip and rip the track as wheeled vehicles have the tendency to do. Whilst Mr Topping operates a rubber wheeled loader at present, he is aware of the damage this vehicle is capable of causing and the restrictions it places on operations. He has plans to replace it. The carting tasks that it does now will be replaced by horses. Loading at the mill will be replaced by a forklift.

One area of concern which Chris Maser [1994], amongst others, has highlighted is the depletion of nutrients from the soil through the removal of wood from the

forest. At present Mr Topping retains much of the tree foliage and branches on site which according to O'Loughlin [1994] is an important management technique to retain and recycle soil nutrients in the forest (the majority of the nutrients in a tree are contained in its leaves and branches). Despite these management techniques and the initial fertility of the soil Maser [1994] claims that in a plantation system eventually the soil quality will decline as will do yields. The advise he gives for plantation systems is to include an extended rotation every two or three rotations and allow an old-growth forest to develop in order replenish the nutrients lost [Maser, 1994]. It is predicted that a near natural management system, such as at Glenhope Native Forest, should not be so vulnerable to soil nutrient depletion from wood removal (as Maser has found in continuous plantation systems) particularly when one of Mr Topping's stated management principles is the maintenance of old-growth forest. This is not to say that Mr Topping should be unconcerned about soil nutrient depletion, in fact, it is suggested he takes steps to monitor the effects his operation is having on the soil quality.

5.5.3 Biophysical/ Social Dimension

The manner in which humans relate to Nature (which makes us unique in the animal kingdom) is through technology. The conventional wisdom of Modernist science, up until recently, was that increases in technology would automatically lead to an improvement in human life. This has undoubtedly occurred in many areas of our lives, however, the environmental and human costs of technological 'solutions' are increasingly becoming evident [Barbour, 1992]. E.F. Schumacher's book published in 1973, *Small is beautiful: A Study of Economics as if People Mattered*, popularised the notion of appropriate technology as a more sustainable solution (see Chapter 3.4). Appropriate technology can be defined as a "*technology tailored to fit the psychosocial and biophysical context prevailing in a particular location and period*" [Willoughby, 1990, p15]. From this definition it can be inferred that technology which is not relevant to the economic, social and

biophysical context in which it operates in terms of location and time is inappropriate and unsustainable.

Schumacher [1973] advocated appropriate technology which is intermediate in scale[20] (fits local circumstances), is labour intensive (rather than highly mechanised), is relatively simple in its design and remains in the control of local people. More recently, two other related characteristics of appropriate technology have emerged. Appropriate technology, firstly, minimises resource use (particularly non-renewable resource use) in favour of renewable resources. And secondly appropriate technology is reflective of the environment in design; that is it attempts to minimise negative externalities. This chapter examines Mr Topping's activities in and relationship with Glenhope Native Forest in terms of the type of technologies he favours and the direction he is moving.

Piers Maclaren believes that probably the biggest single risk factor in the viability of forestry operations is the future price of energy [Maclaren, 1987]. It takes a substantial amount of energy to build logging roads and harvest, transport and process trees [Maclaren, 1987; Collins, 1991]. Maclaren predicts that the price of energy will rise as fossil fuels become more scarce and environmental opposition to their negative externalities grows. This will make it increasingly difficult for those forest management systems which rely heavily on fossil fuels and chemicals, derived from petroleum, to be economically and politically sustainable.

Part of Mr Topping's second guiding principle at Glenhope Forest is to **minimise the volume of inputs into the forest**. His development programme is, therefore, based partly on a reduction on his reliance on fossil fuels and resource inputs. At present fossil fuels form the second greatest expenditure in terms of operational costs (see Figure 11 page 160). Such an goal he feels should not only save on financial and environmental costs in the medium and long-term but also lessen the economic risk should Maclaren's prediction eventuate.

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[20] Intermediate scale means somewhere between large and small scale.

A practical measure he is taking towards reducing the use of fossil fuels is the use of his two Clydesdale horses for transporting timber and other forest products around the forest. While horses do take some care in looking after and are prone to 'having minds of their own' Mr Topping believes that a well trained team of horses are a more 'efficient' form of transportation than any machine he could buy to do the same work. Their initial purchase cost (at around $1500 - $2000 each, plus tack) is cheaper, as are their maintenance and operating costs, than a machine. At ten to fifteen years their life expectancy is about the same as a machine. Weighing up the costs of machinery verses horses, horses work out slightly cheaper, however, Mr Topping sees that their main advantages are 'environmental'. From his experience he has found that they never get stuck in mud or snow, rarely break down and always start on the coldest winter's morning. They can also operate on wet days, whereas if a machine was used it would invariably damage the track. While they may not be able to carry quite as much load as a machine Mr Topping has found that they cause less damage to the track and the trees on the edge of the track than can his dozer or loader can do doing the similar work. He has also started to use the horses to remove branches for firewood from the forest. He found that the cost of running a machine to cart firewood precluded the removal of such material for the returns it provided, but using the horses he has found that the returns outweigh the costs.

In some ways Mr Topping feels he has come full circle in terms of his use of the horses. When he first started out logging in the area he used horses for this purpose. Now he is back using horses again. However, they are not now used for pulling logs along the ground through the bush but simply for transporting logs on a cart or sled along tracks. The heavy work is carried out by machines. Mr Topping concedes that horses would not be appropriate for every forest owner. However, he has found that after beginning with horses nearly twenty years ago and trying various machines since this time he feels that a well trained team of horses is the most appropriate technology for his requirements in this forest.

During the harvest operation, after the trees have been felled and bucked, the logs

are winched by means of a winch mounted on the D4. Once the logs are onto the track they are at present hauled by the Caterpillar to a nearby skid site. Here they are loaded onto a trailer by an 11 ton Michigan loader and later carted to the mill site for milling. The new system which Mr Topping is beginning to implement involves the use of essentially the same machinery but in a different way. Once the system is in operation the D4 will drive in along a contour track and position itself for the duration of the harvest above or below the coupe. The D4 would then winch the logs to the track and load them, by way of a hiab type of swinging-arm crane fitted to the machine, to a horse drawn trailer[21]. The trailer would then be pulled to the mill by the horses and unloaded by fork lift.

While this system requires two additional pieces of machinery (the crane and the forklift) both are smaller machines, than the loader, and should cost less to operate and maintain. The much larger loader would become obsolete. The main advantage of this system is that track maintenance and fuel costs are substantially reduced because once the D4 is positioned it remains where it is until the coupe has been cleared, rather than at present driving back and forward to the skid. This role will be carried out by the horses. Another advantage is that the horses take the logs directly to the mill and eliminate the double-handling from skid to mill which takes place at present. As well as this the logs having little contact with the ground under the new system should cause less soil disturbance and require less preparation before milling than the present system requires. While for this system to work properly it requires a well trained team of horses and much longer contour track than would normally be required in a forestry operation, the system has environmental and other benefits which have been mention previously. This system is not fully operational as Mr Topping is in the process of building the contour tracks, testing different crane systems and is busy putting together his management plan (as required under the Forest

[21] Mr Topping would prefer to exchange the D4 Caterpillar for a hydraulic walking hauler. The advantages of such a hauler is that it is less damaging to the track and it can position itself better for hauling than can a dozer as well as requiring less power to do the same work. However, because the dozer is also useful for track building at the present time and the high cost of a walking hauler such an expenditure cannot be justified.

Amendment Act) at present.

Increasingly the harvesting of indigenous forests in New Zealand is being carried out with the use of helicopters. Heli-harvesting is believed to be an efficient, economic and environmentally sensitive method of harvest [Richards and Solari, 1994]. While Mr Topping has considered the use of helicopters he has decided that for the most part they would not be suited to his style of forest management. He feels that his ground based methods are more in line with the ecology of Glenhope Forest. The use of a helicopter would necessitate both larger coupe sizes than he fells at present and the total clearfelling of the coupe (advanced regeneration of poles cannot be left because of a hazard to ground crew and other trees by helicopter)[22]. He sees that helicopters may have a place in forest management but he also sees that there is a danger in their use of tying the management of the forest to the machine rather than to the ecology of the forest [supported by Gover, 1995].

At the mill site the logs are peeled of most of their bark, particularly where they have been in contact with the ground and picked up stones and dirt. This has to be removed because otherwise it helps to blunt machinery in the mill. The logs are peeled by hand using either a slasher or an axe. While this procedure could be done by machinery such as a chainsaw peeler the wide variability in the logs obtained from a natural forest would make it difficult to process these rapidly. The time required to reset the peeler reduces the time saved by doing it using a machine. Another reason given by Mr Topping for doing this job by hand is that it is one of the few jobs at the mill site free of loud noise. This quiet time is an opportunity to reflect on the forest, to give the felled trees a little of the respect they deserve and to be able to talk to ones workmates about the forest and other things without the noise of machinery usually associated with the mill.

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[22] Visits to two forest where helicopter logging was taken place in beech forests supported Mr Topping's conclusions. Coupe sizes in both forest ranged between about .3ha and .5ha with all trees, poles and saplings being felled.

After the logs have been prepared they are moved by the loader for breaking down before being milled. This procedure involves using a fixed chainsaw mill to break the larger logs into quarters for quarter sawing. Quarter sawing is the preferred technique at Glenhope Native Forest for milling beech, as is generally the case with hardwoods. The method helps to release tension in the wood and prevent warping later [Topping, *pers com*]. The sawmill is a breast bench type powered by a turbo-charged 60hp D4 Caterpillar diesel motor. The mill is best suited for sawing large dimension timbers[23] but will saw down to 12mm x 25mm.

In the near future Mr Topping intends to install a new 10hp wood powered steam engine which would generate sufficient electric power for the mill, workshop and office. The main advantage of a steam-electric system would be a reduction in his reliance on fossil fuels as the boiler would be fuelled from waste wood from the mill and forest (At present the mill produces about 8m3 of slab-wood per day). It is likely that a steam-electric system would require around 7m3 of slab-wood per day to operate. 7m3 of firewood would return around $30 if sold. This can be compared to the cost of the diesel to operate (fuel and maintenance) the present motor of around $72 per day. Not only does the present system require fossil fuel, which comes from outside the area (and possibly from outside of the country), but it costs Mr Topping to purchase it whereas the fuelwood would essentially be free (as a by-product of his operation).

While a steam-electric system does have other disadvantages over the present system, such as its requirement for a constant water supply and possibly a fire risk, these could be overcome relatively easily. Mr Topping sees that a steam-electric system also has a number of other advantages. It will enable him to operate a smaller saw in addition to the present saw without additional fuel costs. This in turn, would enable him to increase recovery rates from the timber he is at present sawing as well as increase his utilisation of smaller dimension trees which are at present graded as firewood. The electricity generated from a steam-electric

[23] The largest dimension which has been cut at the mill was 420mm x 420mm. The longest length cut being 11 metres.

system would also be particularly useful for the office and workshop to power electric tools, etc. It is also envisaged that the heat generated by a steam engine could be harnessed and used in a co-generation system for a low temperature kiln at the mill site. Another advantage of a steam-electric system would be a reduction of noise at the mill; the steam engine would be smaller than its diesel powered counterpart and its design would enable it to be housed some distance from the mill site. One of the main reasons that Mr Topping cited for getting a steam-electric system was to increase his self independence in terms of energy.

Mr Topping also feels that he will have come full circle in the intended use of the steam-electric power system. The system is a modern adaption of the steam operated mills which were (and are still) common in Australia. (Mr Topping grew up in a sawmilling town in Australia where his grandfather and father worked in a sawmill). He believes that this system will be appropriate for his style of management and needs at Glenhope Forest. Although this system may cost more to run, in terms of money that he could have made from the sale of firewood which is required to fuel the engine, he sees this as preferable to spending money on diesel, the winter problems of the present engine (ie flat batteries, fuel thickening), the cost of maintenance on a diesel engine (for the same power, a steam engine is smaller and simpler) and the ability to run a number of other electrical devises off of it. Like the horses, Mr Topping concedes that the steam-electric system would not be appropriate for everyone but he feels it will prove to be appropriate for his needs.

As with many hardwoods the beeches are slow to season, taking approximately one year to air dry per 25mm depth of wood. Pinhole timbers take less time to dry [Topping, pers comm]. Seasoned timbers command a price which is up to twice that of green timbers. Whilst silver beech can be kiln dried from green, the other species need to be dried to 30% moisture content if kiln drying is considered to be an option at all.

A less energy intensive option than kiln drying is drying under cover. At present

all seasoning of timber at Glenhope Native Forest is done out in the open air. The next major stage of development is to build drying sheds which is under way now. Having the facilities to season timber under cover should speed this process up by 20-25%. It should also lead to less downgrade, suncracked, frostcracked and mildewed timber as well as increasing the returns on the timber processed. The sheds are designed in such a way so as not only to keep the rain off of the wood but also to enable stacking to be carried out in wet weather. A wooden tram track will also be constructed around the drying sheds. It will carry hand-operated trolleys so as to enable the easy relocation of timber around the yard.

As already related it is intended to use a steam-electric engine to power the mill. Mr Topping is also investigating the possibility of harnessing the excess heat from the steam engine to increase the temperature in the drying sheds. He is also looking at designing the sheds to make use of passive energy, such as from the wind and sun. As well as looking at more appropriate technologies Mr Topping is also looking at recycling. One example is that he is working on the design of a sawdust/bracken fern oil filter for cleaning used engine oils for reuse as chainbar oil. Part of the reason for this is to save costs on the purchase of chainbar oil but it would also help to eliminate the problem of disposal of the oils.

In summary it appears that after seventeen years at Glenhope Mr Topping has developed a system of forest management and a selection of technologies which he feels are appropriate both to his needs and his scale of operation as well as to the ecology of the forest (or at least his understanding of it). He is focusing on reducing his reliance on fossil fuels, which are a major cost to him, through the introduction of horses and wood as alternative sources of energy. While the horses/ crane/ forklift harvest system and the steam-electric power system both require capital investment in the future the energy requirements would come from the farm and forest in the form of grass and wood, reducing Mr Topping's dependency on fossil fuels. Whereas, grass and wood are still forms of energy, unlike the fossil fuels, Mr Topping has not to derive cash from his forest in order to pay for them. Mr Topping believes that if the price of energy rises significantly the nature of the

forest management system he is developing will help to buffer him against the risk of economic failure. If the price of energy does not rise, as Piers Maclaren, predicts he feels he will still reduce his operating costs and at the same time gain satisfaction of having greater control over his energy sources.

In the wider context it could be said that the nature of Glenhope Forest lends itself to low-energy, low-technology systems of production. The indigenous trees which are extracted from his forest require little in the way of energy inputs save sawmilling. They do not require recomposition, chemical treatments, stains or glues to make them useful. The heartwood of the red and hard beeches is naturally durable. The diversity of timbers which are extracted from the forest supply a range of colours, textures and properties with variable grains and character features to suit all manner of purposes and tastes.

5.5.4 Social Dimension

In the past Glenhope was a terminus for the Nelson railway and supported local farming and sawmilling industries. In its heyday the village of Glenhope boasted a school, post office, railway station, stables (later becoming a petrol station) and tearooms. By 1913 the school had a roll of 32 pupils. However, the industries which supported the township proved not to be sustainable and as they ceased to be, or retrenched in the case of farming, the community slowly declined both in numbers and spirit. Today there is not sufficient to attract people into living in the area being little in the way of facilities or employment.

Mr Topping has a strong desire to see the development (or redevelopment) of the community of Glenhope. He argues that the development of his forest along sustainable lines could bring about a more sustainable community unlike those communities created from the boom and bust industries of the past.

There are a number of families living in the Hope Valley. Most of these people

either work outside of the area or lead "alternative" or essentially subsistence lifestyles. The lack of a focus at Glenhope does not provide for a particularly close knit community. Mr Topping believes that the diversity of opportunities found in Glenhope Native Forest (essentially through the biological diversity of the forest) could provide such a focus. If harnessed, the many opportunities found at Glenhope Native Forest have the potential to offer prospects of long term employment to at least 12 people directly and a number of others indirectly or part-time. Figure 10 below compares equivalent full-time employment opportunities at present compared with the potential number under a regime which makes for a greater use of the forest and its products. If such an idea was to become a reality it could possibly take ten years to come to fruition.

Equivalent full-time opportunity	**Present**	**Potential**
Forest Management/ Planning/ Marketing/ Administration/ Consultancy	½ + ½	2
Silviculture/ Harvesting	½	2
Sawmilling/ Seasoning/ Timber Distribution	1 + ½	2
Seedlings/ Firewood/ Landscaping Products	¼	2
Minor Products ie fungi, possums, bees, wasps etc	¼	1
Resawing/ Furniture or Crafts factory	0	2
Cafe/ Craft shop	0	1

Figure 10. Present and Potential Employment Opportunities in Glenhope Native Forest.

Mr Topping does not wish to be personally involved in developing all of these opportunities himself. He sees this as neither a practical nor ultimately sustainable option. At present he is involved at the forest planning and management level as well as with sawmilling, harvesting and silviculture. To add more to his workload would dissipate his time and energy amongst too many projects. He believes that part of his role as a forest manager is to provide opportunities for people to tap into the forest resource and build up their own businesses rather than directly employing people. This he sees as being ultimately

more sustainable than them working for wages.

Mr Topping's own long-term security as a forest manager and sawmiller at Glenhope Native Forest is maintained through cutting rights he has negotiated with the landowners (it just so happens that one of the landowners is his partner/wife). Mr Topping sees that people who wish to take advantage of such opportunities and utilise products in the forest have to be serious and committed both in the long- and short-term. In order to cement this commitment and offer those people the same sort of security Mr Topping now enjoys, a similar utilisation right, to that of Mr Topping's cutting right, would have to be agreed upon with the landowners.

His basic requirement of people wishing to be involved in any such projects is firstly, that they remain honest in their dealings and secondly, if they take something out of the forest they should also put something back into it. This may be in the form of a royalty to the landowners for resources extracted, but not necessarily so. For example, someone who wants to develop a business around selling plants dug from the forest would be required to, say, carry out a certain amount of replanting and landscaping work on old skid sites and disused tracks in the forest in return for the resource and the opportunity.

Mr Topping and the Pettigrews also have a similar attitude to those wishing to use Glenhope Native Forest as somewhere to recreate. A number of groups carry out different activities such as hunting and camping in the forest. Allowing people to come into the forest and recreate often has reciprocal benefits both to the community and to the forest. For example, people get pleasure from their visits while at the same time wild deer and pig numbers are reduced. In the wider sense Mr Topping never fails to take the opportunity to get across the message of sustainability to the visitors. He is in a particularly persuasive position as he is able to illustrate sustainable management of an indigenous forest with a working example.

In reference to Chapter 3.5 Mr Topping would probably not describe himself as a bioregionalist, however, he does believe in decentralised communities or at least in communities which have the power to make decisions over those things which directly affect them. Two major decisions which have negatively affected the Glenhope community in the last 5 years have been made by people who do not live in the area and do not feel the negative effects of their decisions. These have been, the planting of a pine plantation at the head of Lamb Valley and the creation of a national park near Glenhope (see later in this chapter (5.6.1 and 5.6.2 for a detailed account).

While Mr Topping sees the impracticalities of a self-reliant, self-sufficient region, as aspired by the bioregionalists, he has a definite preference on the destination of his timber. He believes that for New Zealanders to maintain and further develop a cultural appreciation of the qualities of our indigenous woods (and continue to buy them) these products should remain in New Zealand. In his opinion the sustainability of the industry is dependant on people using these products in New Zealand. He acknowledges that for other forest owners this is not part of their economic reality; they have to export to stay in business[24]. It is suspected, however, that Mr Topping's attitude to the export of indigenous timber is at least in part a function of the relatively low competition he has in the region at present.

5.5.5 Social/ Economic

As explored in Chapter 3.7 the ideas of intergenerational and intragenerational equity recognise that many of the decisions regarding sustainability and natural resource use are social decisions. Intergenerational equity is based on the assumption that the welfare of future generations is at least as important as that

[24] Visits by the author to four Southland indigenous forests where the resource is large relative to the number of people who live in the area so the export of timber at least out of the region is part of their economic reality.

of the present generation and seeks to ensure that the allocation of resources is equitable across time. Intragenerational equity is concerned not only about the fair allocation of resources between this and present generations but is also concerned about the distribution of resources between the current generation of humans and between humans and other species.

While Mr Topping may not be familiar with the terms intergenerational and intragenerational equity he would no doubt agree with Turner and Pearces' comment "*that future generations have the right to generate for themselves a level of welfare no less than that enjoyed by the current generation*" [Turner and Pearce in, Barbier, 1993, p190]. Mr Topping believes that he has a moral obligation, or indeed imperative, to care for the needs of the following generations of Toppings and Pettigrews. Mr Topping wants his children to stay on the property and continue the relationship he has begun to build with the forest. Within the decision making process the needs of his children and their unborn children are implicitly taken into consideration.

A number of ways have been identified where Mr Topping is attempting to provide sufficient resources so that following generations are able to meet their needs. He is first and foremostly attempting to keep intact a resource base so there will always a native forest to be passed on down to future generations. Forests being a renewable resource, particularly those being actively managed for a sustained yield of timber, are inherently conducive to providing a fair distribution of resources between generations [Maser, 1994]. However, Mr Topping is carrying this idea further. The forest he wishes to pass on to future generations will not simply be a mixed beech/ podocarp/ hardwood forest but he intends a **biologically diverse** mixed beech/ podocarp/ hardwood forest. His management practices do not attempt to reduce or simplify the forest in terms of ecosystems, species, variety of species, forest structure, tree size or range of age classes. Through his management system he is attempting to foster the current situation with a predominance of old-growth forest. To reduce the forest to a few commercially preferable tree species with a narrow band of age classes, he feels, would bind

future generations to today's preferences. His management system appears to be about 'keeping all options open' [after Wardle, *pers comm*] so that future generations can continue to enjoy and make use of the current diverse range of options the forest provides at present. Perrings [1994] would probably endorse Mr Topping's approach. He claims that because future generations are not in the position to determine which option or range of options they want it is best to attempt keep all options open. Therefore, management strategies which only provide for a narrow range of opportunities for the future are not sustainable [Perrings, in Jansson, 1994].

As previously mentioned the use of helicopters is being promoted as an efficient, economic and environmentally sensitive method of harvesting indigenous forests [Richards and Solari, 1994]. Peet [1992] expects that the fossil fuels on which these machines rely will probably last another few hundred years while the easily accessible resources (such as Middle Eastern oil) will become scarce before the middle of the twenty-first century. While this may sound like a long time the beech seedlings which germinated this year will be significantly less than halfway through their life-cycles in fifty years. A harvesting system which is reliant on a finite supply of a non-renewable resource may preclude future generations from using the renewable resource; the forest.

Mr Topping's harvesting system is based on the assumption that the supply of fossil fuels will tighten and the price will rise. He is developing a forest management system to be less reliant on non-renewable resources particularly fossil fuels. The tracking system which he is constructing at present should ensure that future generations will be able to harvest trees from the forest as the supply of fossil fuels dwindles. Rather than making cornucopian assumptions about the ability of humans to develop cheap sources of energy Mr Topping is making the assumption that the price of energy will never be cheaper than it is now. He is using this present cheap source of energy to build tracks into the forest. He believes that he needs not only to leave future generations an intact resource but also the ability to be able to utilise it.

In the past Mr Topping's approach to development within Glenhope forest, such as the purchase of new machinery and the construction of new buildings and tracks, has been cautious. While others may have been tempted to apply for development assistance and loans Mr Topping saw that it was better both for himself and the forest to stay out of debt. He felt that every dollar that had to be paid in interest had to be paid for from products from the forest. Rather than take the chance of burdening this and future generations with debt, or perhaps even risking the loss of control of the forest through being unable to finance a loan, he felt it was more prudent not to take out a loan at all. In fact, on two occasions he chose to close the mill and seek employment elsewhere rather than go into debt and place the forest and this and future generations at risk. Even now with the business on more of a sound financial basis, due to recently upward trends in the price of native timbers, he is still adverse to being in debt. He would rather 'progress' 'slowly' than risk any loss of control of the forest.

Perrings [1994] noted that the issue of intergenerational equity is not only about a moral obligation on the part of present generations to provide for the resource needs of future generations. It is also about the present generation having an obligation not to burden future generations with negative externalities which are caused by our industry today. Today's generations are feeling a number of environmental effects of the forest industry of the past generation. According to Szabo [1993] there are over six hundred sites in New Zealand which are contaminated with the timber treatment chemicals pentachlorophenol (PCP) and/or copper chrome arsenic (CCA). Their persistent toxicity, which is the desirable trait for which they have been developed, is now proving to be a highly undesirable trait in the context of human health and the environment. This is part of the legacy of past generations which has been left for this generation to clean up.

Mr Topping sees that the diverse range of indigenous timbers and other forest products suitable for a diverse range of purposes helps to ensure a minimal input of chemicals. There are native timbers which are sufficiently durable not to

require preservative treatment and there are an array of indigenous timbers with all manner of colours, textures and properties with variable grains and character features to suit all manner of purposes and tastes. As such they are often useful as they are and do not require recomposition, chemical treatments and stains to make them attractive. If an indigenous timber needs treatment the chances are it is being used for the 'wrong' purpose. Mr Topping argues that by developing an indigenous forest industry he is helping not to burden future generations with negative externalities the likes of which Szabo [1993] has highlighted.

Mr Topping is also trying to foster a positive culture around New Zealand's indigenous forests and an appreciation of and a desire for the many products which can be obtained from these forests. He is confident that a strong appreciation of these products should ensure that Glenhope Native Forest can provide for the livelihoods of generations of people to come. This desire to foster an indigenous forest products culture extends to his belief that supplies of these products should be restricted from leaving the country so as to prevent their price rising to international levels where these products are outside the access of the ordinary New Zealander. He argues that for a sustainable indigenous forest industry to develop it must be strongly tied to local preferences and use. It is unlikely that the sheep farming industry would have ever emerged if New Zealand was full of people with an aversion to sheep meat and wool.

Mr Topping is also trying to provide for intra-generational equity through providing opportunities for people to derive an income from the forest. He acknowledges that there are many more opportunities that the forest can provide and he is able and willing to take on himself. At the present time only a beekeeper derives an income which is totally independent of his timber operation; everyone else that works in the forest is in some way dependant on his sawmilling operation. Mr Topping would like to see more people working in the forest and enjoying the security that both the beekeeper and himself enjoy. Without a stake in the forest it is difficult to have people committed to the forest in this generation let alone in future generations. Mr Topping sees the problem in the lack of

suitable organisational structures. He has investigated setting the forest up as a trust or a limited liability company but no decision has been made as yet on how to improve this problem.

5.5.6 Economic Dimension

The method popularly used today for estimating value or worth of a project, including forestry projects, is the discounted cash-flow (dcf) analysis [see Fraser and Horgan in Hammond, 1995 for forestry applications[25]]. This method is designed to weigh up the costs and benefits of a project over the life of that project. The total costs and benefits are measured in terms of dollars which are discounted over the project life; that is they are calculated and summed in the equivalent of "today's dollars".

"*Although most economic literature accepts dcf as a method for appraisal of long term projects such as forestry, there are some, particularly those who are interested in sustainable development, who are not enamoured with the technique* [Fraser and Horgan, in Hammond 1995, p142]. Probably the most common problem with a dcf analysis cited is the selection of an appropriate discount rate; the choice of which can greatly influence the outcome of the evaluation [Norgaard and Howarth in Costanza, 1991]. The higher the discount rate, the stronger the pressure to maximise present resource consumption and generate negative ecological externalities [Rees *et al*, 1993]. Some have argued that, because sustainable management is a long-term and intrinsically worthwhile practice, the use of a very low (even zero) discount rate has been suggested as a way to overcome this problem [Wardle and Richardson in Cox, 1991; de Groot in Jansson *et al*, 1994; Markandya and Pearce; 1994].

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[25] Fraser in Hammond [1995] says their are other methods used for evaluation in forestry. He does not outline these, nor are they outlined elsewhere in the volume.

Another problem with dcf is that business opportunities in the natural resource management field are often evaluated on the life of the project (or in plantation forestry around the length of one rotation). When asked about the life of the project at Glenhope Mr Topping replied "forever!". This is a sound answer in terms of sustainability but highlights one of the problems of dcf. When one discounts this far into the future[26] virtually no project is worth pursuing, even when using a low discount rate [Belik, *pers comm*]. For example "*a discount rate of 5% effectively means that the value of a given function 30-40 years from now is considered to be very nearly zero today*" [de Groot in Jansson *et al*, 1994]. With a natural forest being managed on a sustainable basis it is also difficult to determine exactly when the "project" ends or indeed even begins; its life is continuous.

Another problem with the dcf analysis in forest management is that it has tended be used to assign value to the timber component of forests only. Less often it is used to value non-timber products or measure non-market values (such as existence and option values) and functions which the forest provides (such as soil, water and biodiversity protection). While it is possible to assign monetary values to environmental costs and benefits the difficulties of doing so often leads to their undervaluation, or worse, zero valuation [Redclift, 1987; Waring, 1988; Richardson, 1994]. The benefits of sustainable management of indigenous forests can thus be seriously underestimated if all benefits of the forest are not taken into account [Pearce and Moran, 1994].

A dcf analysis also down plays the future impacts of any course of action, eg increased erosion due to deforestation, or the fair intergenerational distribution of costs and benefits [Fraser in Hammond, 1995]. It has been claimed that dcf places more value on satisfying present needs as against future needs and "*clearly does not establish the conditions for sustainability*" [Rees *et al*, 1993, p63]. Others have argued against the practice of "discounting the future" as they claim it can sometimes lead to the 'complete' depletion or destruction of the environmental

[26] For arguments sake 120 years (or the short cycle of Mr Topping's management system) could be equated to 'forever'.

asset on the grounds that it is economically rational [Clark, 1976; Rees *et al*, 1993; Rosewarne in Rees *et al*, 1993; Daly and Cobb, 1994]. Redclift [1994] gives the example of the destruction of tropical forests often being recorded as an increase in GDP in national accounts on the basis of this rationality.

While there are problems with using dcf analysis it is acknowledged that environmental economists have developed techniques to attempt to overcome these difficulties. However, this is simply not how Mr Topping regards his forest; ie as a project, with a definite lifespan, with a focus on measurable commodities. For these reasons it was felt that it would be particularly inappropriate to use the dcf. As to whether this project is economically sustainable or not, when this question was posed to Mr Topping he replied "Well I've been here 17 years now and I am still in business". Perhaps the proof of the pudding is in the eating. Saying this however, Wardle [in Cox, 1991] suggested that a better technique for carrying out financial analyses of New Zealand's indigenous forests would be on an annual accounting basis as is sometimes carried out in European forests. It makes the assumption that the costs and benefits will be evenly distributed over time. Figure 11 below quantifies the financial expenditure and income at Glenhope Native Forest.

This is followed by a discussion on the peculiarities and problems within the economic reality of Glenhope Native Forest. The discussion is grouped into four "economic" topics; the headings being utilisation, supply and demand, price and cost, and risk and uncertainty. In order for Mr Topping to stay in business he has to ensure the supply of products from the forest continues, he has to ensure that there is a demand for his forest products, he has to receive a price for these products which pay for the cost of sustainability and he has to "insure" his operation against risks and uncertainty.

Expenditure	$
Labour - harvesting/pruning/thinning	80000
- sawing/stacking	80000
Fuel and oil	20000
Maintenance - vehicles (2 x landrovers)	5000
- chainsaws (6)	7500
- mill	2000
- other machinery (loader, dozer)	9000
New machinery	16000
Admin., stationary, promotion, subscriptions, etc	4000
Planning	10000
Development	10000
TOTAL	243500

Income	$
Sawn-timber including flitches	225000
Firewood	24000
Landscape and craft products eg seedlings, stumps, hollow rounds, burls, etc.	50000
Consultancy, external harvesting, etc	15000
TOTAL	314000

Figure 11. Annual expenditure and income for Glenhope Native Timbers

5.5.6.1 Supply and Demand

Mr Topping sees the maintenance of old-growth forest as integral to the management of the forest. He believes that not only does it make ecological sense

but it also makes economic sense. His resource base is at present mostly old-growth forest and he wishes to maintain much of the forest in this state. A fast grown tree generally does not have the same character traits as those which are found in the older slow grown trees. The colour in the wood of slow grown trees tends to be deeper, the ratio of heartwood to sapwood is higher and the growth rings are spaced more tightly than trees which have grown relatively fast. The old-growth forest also supplies an abundance of character grade timbers such as fiddleback, birdseye, knotty wood, pinhole, burls, hollow wood, sapstain and curved flitches. These timbers are all steadily increasing both in popularity and price while at the same time the supply is dwindling. These are what Mr Topping defines as his quality timbers. While it is probably safe to assume (like most other timber growers) that there will always be a market for fast grown, knot free, straight timber Mr Topping believes that in the future the timbers from the old-growth forest will fetch the higher prices. In fact he is already beginning to experience this happening. Mr Topping is managing his forest in such a way so as to have a continuous supply of the diversity of products which his customers want and only this type of forest and forestry can provide.

In the past the demand for native timbers did not have to be stimulated. New Zealanders', both Maori and Pakeha, had an historic and cultural association with and appreciation of their native timbers. Alternatives did not exist except for a small amount of imported or home grown exotic timber. Until recently there was little problem with supply although problems of distribution did exist as forests available for utilisation were not spread evenly over the country [Roche, 1987]. As well as this the price of indigenous timber was held artificially low through price controls introduced by the government in 1936 with the intention of making home ownership within the reach of the poorest citizens [Hinds and Reid, 1957]. These price controls were lifted in 1979 [Tilling, 1992].

However, there has been a growing backlash against a history of destructive and exploitative practices within New Zealand's indigenous forests which may be affecting the demand for their timbers. One challenge for Mr Topping is to present

the case for sustainability within indigenous forests so as to stimulate demand. Often the people who he would prefer to sell his timber to, ie those with an environmental consciousness, will not buy it because of past (and some current) destructive practices of land clearance and forest 'management' within indigenous forests. Mr Topping is trying to encourage demand through an active publicity campaign with a focus on sustainability. He has produced two pamphlets on his interpretation of sustainability and the practice of it at Glenhope Native Forest. Mr Topping never fails to take the opportunity to educate customers and visitors on the benefits of sustainability. The other challenge for Mr Topping is to create a demand for a group of timbers whose properties are generally excellent but largely unknown by the public. One again he is creating awareness and he hopes demand through his publicity campaign.

Although Mr Topping is stimulating demand for his forest products he is also trying to get his customers to understand the peculiarities of working within a natural system. He is trying to get the message across that one cannot make demands over and above the ability of the forest to provide products at a sustainable rate. While the diversity of the forest invariably contains the diverse range of products that his customers want it is not always possible to meet these demands with an immediate supply. The nature of the resource in a biologically diverse forest is unpredictable and often contains features of an unknown quality and quantity[27]. If an order arrives, for example, for an uncommon feature wood (or even for a particularly large quantity of a more common wood) often it can take longer to fill the order than a customer would normally expect. To operate the forest under a system based on the demands of the customer rather on the products and the rate at which the forest can supply would operate outside Mr Topping's interpretation of sustainability and invariably lead to practices where he was "creaming" or high-grading his forest for desired products.

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[27] In a plantation forest the quality and quantity of timber can be predicted to a relatively high degree of accuracy due to the simplicity of the forest structure and species composition as well as relatively few "defects" in the timber.

Having a stockpile of timber and other forest products on hand would go a step towards solving this problem, however, to stockpile one has to have the finance to enable one to do so. Mr Topping also feels that it is ultimately better in the long-term to educate people to the peculiarities of sustainability rather than stretch its boundaries in order to satisfy their demands. Consumers have to realise that working with instead of against Nature can sometimes take more time.

5.6.6.2 Utilisation

As discussed previously (Chapter 5.5.1), the volume of timber Mr Topping is permitted to extract from Glenhope Native Forest is restricted both by the Forest Amendment Act 1993 as well as Mr Topping's own forest management principles. The best way that he sees to increase the value of the products extracted from the forest, outside of changing societies preferences, is through better utilisation of the **whole** forest and its biological communities; not just the 'preferable' tree populations. In the days of the clearcut at Glenhope Native Forest the products removed from the forest were destined for two purposes; clear butt logs generally went to the sawmill at Tapawera and the remainder of the wood went to the chipmill in Nelson. Sometimes even clear logs were chipped. Today timber utilisation is much improved and, similarly, the list of products being extracted from the forest and uses to which they are being put is rapidly expanding. Utilisation of timber (or woody biomass) and utilisation of the remainder of the forest ecosystem will be discussed in this order.

Timber

Mr Topping's conversion rate from sawlog to sawn timber at present is close to 40 percent. This is low, even for beech. Wardle [1984] puts the average conversion rate for beech between 44 and 48 percent. A relatively high proportion of defect wood is part of reason for this low conversion rate but Mr Topping also

acknowledges that this is also because he has a high percentage of slab timber. This slab timber is at present sold for firewood. It could, however, be milled down to smaller dimensions and component parts. Although his present mill can cut to smaller sizes it is not really suited to this purpose. The demand for smaller pieces, by furniture and toy makers, and the desire to better utilise the timber has led Mr Topping to consider the purchase of a smaller sawmill. A 10 horsepower, electric or small tractor powered mill fitted with a 35 - 40 cm circular blade would be ideal for resawing these smaller pieces of timber.

Mr Topping feels that grading is possibly one of the most important tasks at the sawmill in terms of seeking better utilisation and making the most efficient use of every tree harvested. Poor grading can substantially decrease profits as well as give a timber a poor reputation. As the qualities of the beech species are often unfamiliar amongst the general populace a bad reputation is something the industry can ill afford. He also believes that the greater the number of grades that can be developed the better the utilisation of timber can be achieved. He is steadily increasing the number of timber grades so as match the timber to an appropriate end use. At present he sells 11 grades of timber including the standard building and dressing grades from four species of beech and occasionally two podocarp species. He hopes to develop markets to allow him to have more grades including non-standard sizes and those species which are not generally considered to be timber trees. It is imperative once the timber is graded it is also stacked well otherwise ones efforts will be wasted. At Glenhope Forest each layer in the stack is separated by fillets of 1cm x 3cm x 1.2 metre at 300mm intervals for large dimension timbers and 600mm intervals for small dimension timbers. Each fillet is laid directly over the fillet below it in order to help prevent warping in the timber. Building and landscape grades of timber do not require seasoning but are also stacked in this way if being stored to prevent warping.

Mr Topping is also developing special purpose lines, such as character grades and flitches, to improve the utilisation of his timber. In the past "defect" and "mis-shapened" trees, trees characteristic of the old-growth forest, were downgraded or

sold as firewood. Today the value placed by his customers on "poor quality" timber, timber containing "defects" such as fiddleback, birdseye, knotty wood, pinhole, burls, hollow wood and sapstain is steadily increasing. Today these features are realising an economic value for purposes as diverse as exposed beams, bar tops and "pots" for landscaping purposes. Amongst his customers Mr Topping has makers of musical instruments and fine furniture, artists and woodturners who are prepared to pay high prices for wood containing these features[28]. At a recent timber auction Mr Topping received double the price for his curved flitches as he did for his straight ones. The buyer assured him he would have been prepared to pay a lot more in order to secure these flitches. Mr Topping is encouraging his customers to buy their timber in flitch form and resaw it themselves, particularly where the end use is for furniture or interior building purposes. In this way not only can the character features in the timber be best be put to best use but also the craftsperson is not restricted by the standard dimensions of sawn timber. The timber can be cut by the craftsperson to the exact dimensions required thus helping to eliminate waste and increase utilisation. Such a focus on utilising the forest as it exists and making better use of the products which come out of the forest is seen by Mr Topping as one way in which to reduce the need to remove the present volume of trees coming out of the forest as well as ensuring the protection of the biological diversity within it.

Mr Topping also intends to manage kanuka on a sustainable basis for both timber and firewood. Kanuka has been utilised in the past as a small dimension timber because of its high density and hardness[29] but has lost favour in recent times partly because of a reduction in the volume of larger dimension trees (see footnote 18, page 131 for a possible management schedule for kanuka). There is approximately 150 hectares of Kanuka in the forest and about the same again on

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[28] Mr Topping has one huge burl which is for sale at $50,000 to be collected when the tree on which it is growing dies. Whilst he has not sold it yet he is confident that he will do so.

[29] Bier [1983] attributes kanuka (*Kunzea ericoides*) with the following properties; mean nominal density 757, mean modulus of rupture 138 and mean modulus of elasticity 12162. Properties of hardness, strength and resilience are not listed.

the farmland.

Waste wood is also sold to a number of local firewood merchants who, in turn, sell it in Nelson and as far away as Ashburton. At present most of the firewood comes from slab wood and rounds which cannot be utilised at the mill. With better utilisation these sources should decrease. In the near future it is hoped to start to manage the kanuka for timber with the thinnings being made available to firewood merchants. As the average diameter of the beech thinnings in the cutover increases it is also envisaged that they will also be able to be sold as firewood. With his new harvesting system in place Mr Topping also sees that it will be possible to remove greater volumes of slash from the forest to make up for a reduction in the firewood resource due to improved utilisation.

Other wood products

The principle of maximising utilisation is not only being applied to that part of the tree which is generally considered to be the marketable part. Parts of the forest which were in the past considered to be waste, ie sawdust, bark, tree stumps, roots[30] and seedlings are beginning to have their potential value realised. Mr Topping wishes to make the fullest possible use of the diversity which his forest has to offer. The ideal is to make use of all species (including traditionally non-timber species), of all stages of their lives (from seedlings to old-growth trees), and to utilise the whole tree (including sawdust, bark, tree stumps and roots). Mr Topping believes that the potential for making greater use of the whole of the biological diversity of the forest ecosystem is only as limited by the imagination and creativeness of people working in the forest.

As mentioned, Mr Topping is trying to develop markets for all parts of every tree that is removed from the forest. Traditionally the most highly valued portion of a tree is the butt log. While this will continue to be a focus he is developing

[30] Much of the high quality character timber and the strongest wood is in the stumps and roots (Topping, pers comm).

markets for sawdust, bark, branches, stumps, and roots. At present sawdust and bark is sold for uses such as a garden mulch. However, higher returns could be gained if it was marketed for use the purpose of smoking fish and meat or used in the manufacture of potting mixes. In the past chemicals were extracted from beech bark in the Nelson area for use in the tanning industry [Clifton, 1990]. Perhaps chemicals extracted from beech waste products could once again provide an alternative to synthetic chemicals.

Two parts of beech trees which are rarely utilised are roots and stumps. Much of the character timber of a tree lays in its roots. Features such as twisted grain and fiddleback abound
[Topping, *pers com*]. The qualities which have helped to anchor the tree to the earth are also sort after for making gun butts; fiddleback acting as a natural shock-absorber. Mr Topping sees a market for gun butt blanks made from the roots of trees, with the price for a good one potentially around $200.

At present Mr Topping removes the easily accessible stumps from the forest during harvest and track construction, and places these amongst areas of kanuka regeneration on the side of the road through the forest. The dirt on and around the stumps and roots contains beech, ferns and other plants, seeds and seedlings. These stumps serve as a seed source and offer the right conditions for other species to recolonise these sites. He also speculates that with some marketing these stumps could become an appealing item for landscaping purposes or for those wishing to regenerate a small "forest" on their quarter acre section.

Non-timber products

Another idea which has been trialed at Glenhope with the intention of increasing the utilisation of the forest is the collection of seedlings for sale. In the process of logging and constructing tracks it was felt by Mr Topping that perhaps some of the seedlings and ferns on these sites could also be dug up, bagged and sold. He gave a local community group the opportunity to collect plants over a three day

period and to keep any profits made for themselves. They managed to collect, bag up and sell $14,000 worth of seedlings and ferns. He feels that there is an opportunity for a private individual to set up a full time business based around such an activity. This would not only create an employment opportunity and put to better use plants that at present are being wasted, but, it would also create a mechanism by which Mr Topping could revegetate disused tracks and skid-sites and carry out landscape work around the mill.

In the past Mr Topping used to keep bees himself in Glenhope Native Forest. However, he found that his operation consumed too much of his time and was too small to be financially viable. Today 60 beehives are kept by a private bee keeper on the property as part of his wider operation. Honey yields are particularly high in Glenhope Native Forest considering the altitude and climate. The yields are in the range of 20 to 30 kilograms per annum per hive[31]. The diversity of tree species on the property ensures that even though the growing season is short, food is able to be sourced right throughout the growing season. Honeydew is gathered by the bees in early spring and again in autumn with kanuka providing pollen throughout the summer. This species mix serves to even out the fluctuations in the quantity of food available and the number of bees available to gather it.

Mr Topping sees much of the future of indigenous forestry in the so called 'minor products'. This is not to imply that he will be shutting down his sawmill but he views the forest as being much more that timber; timber is only part of the whole. He sees that other forest products as diverse as essential oils, lycopodium, stumps, moss covered rocks and logs will become increasingly important in indigenous forestry particularly for those forest owners covered by the Forest Amendment Act, 1993. He acknowledges it is unlikely that Timberlands West Coast will become involved in minor products, however, he also questions the sustainability of their operation.

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[31] The New Zealand average over all climatic zones is 27.9 kg/annum/hive with the range between 17 and 41 kg/annum/hive for the years between 1971 and 1994 (National Beekeepers Association of New Zealand, 1995).

5.6.6.3 Marketing and Sales

Mr Topping markets and sells his timber mainly to local builders and furniture makers, however, he has recently carried out a national promotion campaign in order to widen his customer base. The campaign has concentrated on getting his interpretation of sustainability within Glenhope Native Forest across to his existing and potential customers. Mr Topping focused on two things. One was the development of long-term supplier customer relationships. Such long-term relationships are important to develop with people who are paying a higher price which sustainability necessarily requires and who are dealing with a group of timbers whose properties and uses are not widely known or generally accepted. Mr Topping believes that his customers have to genuinely believe in both the concept of sustainability and the product, and promote them through their business for his marketing strategy to be successful. He feels that in return for supporting an environmentally sound business with a social consciousness his customers can be assured of a continuous source of high quality and well graded timbers now and well into the future.

His other message, which forms a focus for his promotional campaign, is to try and get people to understand that when one is dealing with Nature demands cannot be made on it over and above the rate at which it is able to supply. Mr Topping is attempting to get customers to understand that if they make an order it cannot simply be extracted from the forest in the same way that it could be with industrial forestry. The customers' requirements may be located in the forest, however, these can only be extracted as the forest "gives" them; it is not just a question of supply and demand. Working outside of what the forest can "give" is working outside of what sustainability is according to Peter Topping.

This second point, which highlights a problem with supply and demand in a natural managed forest, could partly be overcome through cooperation between forest owners in the area. This is happening at present, albeit on an informal basis, whereby if one forest owner cannot fill an order in the short term s/he

contacts others in the area to see if someone else may help to make up the order. Mr Topping believes that a more formal solution may be for the forest owners to set up a centre for marketing and distributing the range of forest products to help with evening out the many ebbs and flows associated with working with an unpredictable natural system.

A move in this direction has been the establishment of an organisation called the New Zealand Native Forest Producers Association. The NZNFPA is based in the North West Nelson area. It intends to promote and market both the philosophy of sustainability and the produce coming out of indigenous forests. A logo has been developed by the organisation which members have the right to use to help sell their produce. The NZNFPA acts as a self policing agency in that all members must come up to a certain standard and operate under a code of ethics (unwritten) in regards to the practice of sustainability in their own or other people's forests. If a member fails to come up to the standards or breaks the code of ethics set their membership can be revoked. If this happens they then lose the right to sell their timber under the NZNFPA banner and suffer the stigma attached with the termination of their membership.

5.6.6.4 Price and Cost

The financial costs associated with sustainable practices are often higher (at least in the short term) than those associated with "unsustainable" practices. Practical techniques for "achieving" sustainability which Mr Topping uses, such as long contour track systems, small coupe harvests, and the sorting of timber into a numerous grades for improved utilisation, necessarily requires higher costs. In order to remain economically viable, while adhering to his principles of sustainability, Mr Topping has to build these costs into the price of his forest products. The price he charges for his timber is also related to the price which other producers are prepared to sell their timber for. He is finding it particularly difficult to compete with those who are selling beech which is sourced from

"unsustainable" resources. These producers are not building the additional costs of sustainability into their price and are able to undercut those that do.

Despite the additional costs of sustainability Mr Topping is finding that more and more people are prepared to pay this additional price. However, Mr Topping believes that those that don't pay the additional price, those who prefer to go to a cheaper unsustainable source in the belief that they have no responsibility to future generations and the cheapest source is the best source are only fooling themselves. He operates a policy whereby if a customer forsakes his (or other sustainable suppliers') native timber for an unsustainable source then if that customer ever comes back to buy timber he has no hesitation in selling it to them. However, they pay 20% more than the listed price.

Mr Topping has joined forces with other native forest owners in the region with one of their stated aims as to "*Promote production of added value solid wood products priced to meet the true costs of sustainability*" [New Zealand Native Forest Producers Association, 1994]. It has become apparent that such an organisation is required as the playing field is not level. At the present time there are forest owners who are exploiting their forests as fast as possible in order to extract as much timber before the Forest Amendment Act, 1993 comes into full force on 1st July of 1996. While after that date all private forest owners will have to have a management plan or permit in order to cut native timber two major players in the industry are exempt from the legislation. Forests reserved under the South Island Landless Natives Act, 1906 and Forests managed by Timberlands Westcoast Ltd contain sufficient volumes of timber and operate under less stringent regulations so as to actively depreciate the market for indigenous timbers. The NZNFPA believe that as a coherent organisation the forest owners should ultimately be better placed to market themselves under the banner of sustainability in order to have a market advantage. Such a system should help Mr Topping, and his fellow producers, to achieve a higher return per unit for their timber, allow them to build the cost of sustainability into their price, and reduce the need to extract high volumes of timber out of their forests while at the same

time having sufficient demand to remain economically viable.

5.6.6.5 Risk and Uncertainty

The future is inherently uncertain. This is particularly so for forestry because of the long periods of time which are involved; the further into the future the less certainty there is and the greater the risk [Randall, 1987]. Changes in the condition of the forest, consumers' preferences, or the financial viability are examples of the types of risks which can markedly affect predicted economic outcomes. It appears that part of the reason more people are not involved in sustainable management of indigenous forests in comparison with exotic plantation forestry is the perceived risk factor. Mr Topping does not see the risk of this type of forestry as high as one might suppose. His rationalities and strategies for risk avoidance are outlined below.

The focus for Mr Topping in reducing risk and uncertainty revolves around a celebration of the biological diversity of the indigenous forest. In order to insure himself against the fickleness of the market and changes in consumers' preferences Mr Topping is developing a diversity of products which are being extracted from Glenhope Native Forest. At present these include at least 6 timber species (4 beech, rimu and kanuka), 11 grades of timber, 8 types of character wood (including curved flitches), firewood, and 2 types of honey. There is also the potential to extract seedlings, ferns landscaping products, roots and stumps, wasp larvae and fungi amongst others. By actively seeking to widen his portfolio of products extracted from the forest he spreads his risks and avoids wild fluctuations in the market place; if the price falls for one product his operation can be keep buoyant by rises or stability in other products.

In conventional plantation forestry the most usual way to protect the owners investment against natural catastrophes, such as fire and windstorms, is through a combination of insurance policies and preventive measures such as surveillance

and fire breaks [Robinson, 1995]. New Zealand's indigenous forests (particularly the beech forests[32]) have evolved in conditions where disturbance and catastrophe is common [Wardle, *pers comm*]. The forests tend to have either evolved a natural resistance to disturbance, including fire [O'Connor cited in Rosoman, 1994] or disturbance is actually part of the natural life-cycle of the forest [Wardle, *pers comm*]. Mr Topping is aware of these phenomena and uses them to his advantage. The small coupe felling regime which he employs are likened to small disturbances, ~~albeit human~~ induced ones. Over time a mosaic of managed coupes will develop, theoretically each with an ability to resist different forms of catastrophe.

Insurance policies against perils other than fire, such as pests and disease, are difficult to obtain [Robinson, 1995]. In the plantation forests typically these are prevented through a combination of approaches such as chemical sprays, the use of resistant crop species, improving stand health through silviculture and better forest hygiene, and introducing biological agents such as parasitoidal and predatory insects, pathogenic fungi, bacteria and viruses [Gadgil *et al*; 1995]. The trees of New Zealand's indigenous forests, however, have co-evolved with their parasites over a long period of time and have reached a natural balance [Gadgil *et al*, 1995; Wardle, 1984]. They rarely require such treatments and techniques, apart from maintaining general forest hygiene.

Occasionally a disease or insect population outbreak does occur leading to sometimes substantial forest dieback. An often cited example of this pattern occurred in the Maruia Valley. Following a series of droughts in the mid-1970's an outbreak of the scale insect *Inglisia fagi* occurred causing extensive forest damage and dieback covering areas of up to 10km^2 in size [Hosking and Kershaw, 1985]. Such events are considered to be brought about by the temporary failure of factors which normally control the particular organism [Rawlings, 1953 in Wardle, 1984].

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[32] John Wardle also argues that disturbance is a common feature of New Zealand's other forest types.

However, they appear to be rare in mixed indigenous forests but more common in the mono-specific beech forests [Gadgil *et al*, 1995].

Mr Topping's insurance against such events is through the maintenance of a diverse range of species, gene pools and age classes within his forest. If an insect outbreak does occur, whether exotic or introduced, it should tend to attack only parts of the forest, rather than the whole forest. In the Maruia Valley example the outbreak of *Inglisia fagi* resulted in virtually all the damage being done to one age class of one species, *ie* the old-growth red beech. Monoculture plantations (of in horticulture, agriculture and forestry) are sometimes cited as being particularly vulnerable to insect and pathogen outbreaks because of their narrow genetic base [Rosoman, 1994]. In contrast, in natural forests a higher biological diversity (at the ecosystem, species and genetic levels) is said to confer resilience and stability [Sargent and Bass, 1992].

One of the most commonly cited insect 'pests' affecting indigenous forests has been the native pinhole borer (*Platypus* spp.) [Hilliard, 1992]. Mr Topping believes that probably too much emphasis and research has been placed on the control of this insect. While his management techniques do not encourage outbreaks of *Platypus* he feels that the pinhole borer is an integral part of his forest and is managing his forest so as to actively perpetuate their occurrence. It actually makes economic sense for him to do so; pinhole heart is not only one of the most sort after of the character timbers now but the occurrence of it in timber tends to speed up its drying time.

Mr Topping's development programme is based partly on a reduction in his reliance on fossil fuels (see Chapter 5.5.3). The rationale behind this is not only to save on costs now but also to lessen the risk of economic failure should energy costs rise significantly in the future. Practical measures he is taking include the use of horses for the transportation of forest products within the forest and the installation of a wood powered steam engine to generate electric power for the mill workshop and office. Also by constructing a permanent track system now rather

than a temporary one, Mr Topping, is "insuring" himself against dramatic rises in energy prices affecting his ability to construct new tracks and make harvests in Glenhope Forest.

5.6 Comparison of Other Forest Land Uses in the Area

In order to make a judgement on the sustainability or otherwise of Mr Topping's operation at Glenhope Native Forest it was felt that a comparison of other land uses in the area would be useful. While a comparison of other indigenous forest operations could also have been beneficial it was felt that it was better to compare *local* attitudes to Nature than others outside of the area because of their own mix of local peculiarities.

In both cases the land, in terms of vegetation and topography, had similar classifications to that of Glenhope Forest. Although one could be called a conservation project, Kahurangi National Park, and the other a development project, industrial forestry, there are surprising similarities in regards to sustainability which could be explained in terms of Postmodern theory. It is argued in this section that in contrast to Mr Topping's interpretation of the concept their long-term sustainability is questionable.

5.6.1 Kahurangi National Park

Kahurangi National Park is New Zealands newest national park (yet to be officially gazetted). It will be our 13th and second largest national park and covers much of the North West Nelson area. Few would disagree to the worth of another national park for New Zealand and the value of it to the region, both in terms of biodiversity protection and benefits to the regional economy. However, the benefits and costs of the park appear not to have been equally distributed and the long-

term sustainability of the park is questionable. Some communities such as Karamea and Collingwood, which form the gateways to the park, will obviously benefit economically from the park's new status. Mining, hydro-electric and Iwi interests have also in many cases been successful in getting their concerns addressed. In each case allowances were made and areas of Department of Conservation stewardship land were excluded from the park in order to meet their needs.

However, many smaller communities, such as Glenhope, have already been negatively affected despite the park's only recent designation. While some areas have been left out of the park for the purposes of sphagnum moss collection they are invariably in areas which have also been left out for hydro-electric power purposes. There are no areas near Glenhope now where this activity can legally be carried out. A number of huts have also recently been removed from the park. While the huts may not have had high use the users of these huts were more often than not local hunters. This move has annoyed many local people and has done little to get them on side with the Department of Conservation. The reason many of these huts were originally built was for deer control purposes. Now the huts have been removed it is reasonable to assume that less people will visit these areas and the deer and other wild animal numbers will increase.

Of the kaka it has been claimed that the survival of the species is not threatened by any lack of habitat, but by the Department of Conservation's inability to control stoats, possums and wasps in the bird's extensive habitat [Maruia Society, 1994; Smith, 1994]. The Department of Conservation have neither the field staff nor the finances to carry out any large-scale control of these pests and it is also a reasonable assumption to make that the kaka and other bird populations will suffer as a result. Now that much of Department of Conservation land in the Nelson area is in National Park or otherwise protected in reserves the opportunities for some of the Department of Conservation stewardship land to be used for low impact sustainable management forestry in the future have also been negated.

A more sustainable option may have been to fully protect the high priority areas within the park. Then create a buffer zone in from the present park boundary which would remain in Department of Conservation's stewardship but in which activities such as sustainable forestry could take place. In this scenario these activities would not be permitted at present but perhaps in two or three generations when the concept of sustainability in indigenous forestry is publicly acceptable and a tradition and practice has been well developed. Such an option would provide for a financial base for the Department of Conservation, have more people on the ground dealing with such pests as deer and wasps and give people a stake in and incentive to protect the resource.

The present option has bound future generations to the decision of this generation and has placed the long-term sustainability of the park in jeopardy. Overseas experience has shown that in countries where the pressures by the human population on the environment is high, such as Thailand, Malawi, and Nigeria[33], encroachment into national parks and the removal of timber and the taking of birds and animals from them is prevalent. It is the author's opinion that ultimately Kahurangi National Park will not be sustainable. As the population pressures increase in New Zealand it is felt that these sorts of problems will begin to impact upon our national park and reserve system. This example illustrates a Modernist approach to conservation, one which sees humans not as part of Nature but existing outside of it. The Modernist solution has conservation and development as mutually exclusive; activities being only one or the other.

5.6.2 Industrial Forestry

During the late 1970's a property near Glenhope owned by C.Gibbons Holdings Ltd was clearfelled of its beech/podocarp forest (c250 hectares). Most of the logs from the forest were sent to the Nelson chipmill for export. By the early 1990's the

[33] Countries visited by the author where these problems have been observed to be happening.

property was vigorously regenerating back into beech and kanuka. In late 1991 the adjoining landowners, the Toppings and Pettigrews, were told that the property had been sold to a Nelson based consortium and plans were afoot to convert the forest into a *Pinus radiata* plantation. A few days later a helicopter arrived ready to spray the area in preparation for the project. Mr Topping objected not only to their activities but also to their style of communication. An interim enforcement order was obtained by the Maruia Society under the Resource Management Act 1991 and the project was placed on hold by the Planning Tribunal. However, regulations promulgated in February 1992 by the Ministry for the Environment effectively amended section 369(5) of the Resource Management Act removed the rights of the public to object to such activities [Maruia Society, 1992]. The order was withdrawn by the Tribunal and spraying and burning of the regeneration commenced shortly after. *P.radiata* was planted over the whole property during the winter of 1992.

While this industrial forestry project **may** be sound in terms of economic theory it is far from sustainable in terms of its ecological or social dimensions. The natural system has been virtually totally subjugated over. The original indigenous vegetation was clearfelled and thirteen year old beech and kanuka was eliminated except where it escaped spraying and fires. The intention of the investors was to reduce the biodiversity of the forest to one; that is one species of the same age. Spur tracks are common over the property with anecdotal evidence pointing to increased erosion and a deterioration in the water quality downstream [Topping and Pettigrew, *pers com*].

The project has at best had no effects on the local community or at worst it has had negative social impacts. The people who live in the area have to look at a landscape which some euphemistically describe as scarred. Two farms suffered the short-term consequences of herbicides in their water supply and continue to feel the effects of an increased silt load in the streams which pass through their properties. The project has brought no jobs to the area, nor has it encouraged people to stay in Glenhope or created a long-term industry. The workforce for the

project came from Nelson. Throughout the life of the project it will require only short-term contractors; invariably from outside of Glenhope. In thirty years time once again the people of Glenhope will face again the impacts of logging, burning and chemical sprays with no identifiable benefits.

This project is recognisably Modernist in its rationality with its single objectiveness. The relationship between the forest and its shareholders is one of domination rather than respect. The people who will receive the benefits of this project are not the same people as those that feel the negative effects. A more sustainable project would have provided for long-term employment for local people and allowed them to respond to the effects of their actions. A more sustainable project would have taken into consideration the effects of the project on water, soil and biodiversity values. It may have lead to a rationality where indigenous species were favoured or perhaps mixed with exotic species.

Future generations may have to pay the price of sustainability for this project. It is envisaged that in thirty years time the social conditions governing the harvesting of exotic species may be as stringent as they are now with indigenous species [Wardle, *pers com*]. The economics of this project may not be nearly so attractive then as is set out in its prospectus. Similarly the environmental conditions are proving to be difficult as the *P.radiata* has suffered a considerable amount of snow damage recently and in places is being out-competed by beech. Trespass and poaching are also a continuing problem as the owners of the forest receive little respect from some of the local people. This is possibly a function of the treatment by the consortium both of the local people and the forest.

5.7 Conclusion

Peter Topping or "Toppy" as he is more often known, appears to have what could be described as an unconventional approach to the management of an indigenous forest in New Zealand. Over the last two hundred years the management of

indigenous forests in New Zealand has generally involved one of two options. They have either been treated as a 'timber mine', or a non-renewable resource [after Goodland, *et al* in Costanza, 1991], whereby they were harvested until exhausted and then planted in grass or exotic trees or else they were almost completely protected from utilisation in national parks and reserves. He is, therefore, amongst only a handful of people in New Zealand who have attempted to manage their forests both for conservation **and** utilisation. He values the forest both for its own sake as well as a potentially continuous source of timber and forest products. For this reason alone his approach could be described as unconventional.

However, this is not the only reason for reaching this conclusion. Some of his forestry practices and rationalities would also appear to be unconventional to a Modern university educated forester. Rather than coming from a single economic, or ecological, or social standpoint he appears to base his decisions on a mix of rationalities. The rationalities are based on his knowledge which has been developed over a number of years while living and working in his forest. For this reason he has had to view his forest from many perspectives and take into account the whole. His understanding of the forest and its dynamics have developed from what Wright [1992] may refer to as "wild knowledge".

Mr Topping has taken many of his cues from the forest. He has seen and felt the effects of his influences on the forest and adjusted accordingly. On occasions the forest has reacted in what he considered to be a negative way causing such things as slips, windthrow or what he considered to be unsightly views. He then discontinued or altered his management practices according to the lessons which the forest offered in order to help prevent their recurrence. Things that have given positive results he has pursued. The relationship between the person and forest thus appears to be one of adaptation and co-evolution. He tries to create changes in the forest with respect and of a small nature on an understanding that the forest will respond in the same way.

Generally the primary economic goal in forestry is to maximise the return or profit

to the owner from the sale of wood [Maclaren and Knowles, in Hammond 1995]. While Mr Topping is interested in making his living from the forest he does not pursue this as the primary goal. If there is a primary goal it is with the conservation of the forest, particularly the old-growth forest. He recognises that the old-growth forest has higher ecological values and is more biologically diverse that forests (even indigenous forests) managed on short rotations. He also appreciates the values contained with the other forest areas such as the regenerating beech cutover, the kanuka forest and the small areas of podocarp re-establishing in the valleys. He values the range of variability within the same species. Mr Topping aims to perpetuate and enhance this diversity where he can.

A commonly held view is that the application of economic mechanisms to natural resources necessarily leads to losses of biological diversity [Groombridge, 1992]. While Mr Topping appreciates the "non-economic" or intrinsic values of the forest he argues that the best way to perpetuate the forest and the biological diversity it contains is to make use of this diversity. If the diversity of the forest can be aligned with the diversity of society this can both provide a range of economic opportunities as well as help maintain the biodiversity within the forest. As such, he is always searching for new grades of timber or new lines of products which may be utilised from the forest. In the opinion of the author it is believed that this strategy places Mr Topping in a sound position for 'achieving' sustainability.

In regards to the reconceptualised model of sustainability Mr Topping has considered all the six (sub)-dimensions in the management of Glenhope Native Forest. In terms of the economic/ ecological dimension he is at present operating at less than 10% of the biological sustainable yield with an expressed policy of never operating at more than 80%. In terms of the ecological dimension he has an expressed intention of maintaining a high percentage of old-growth trees within the forest. He has also developed and continues to develop management techniques which attempt to mimic the natural processes of the forest. In terms of the ecological/ social dimension he is trying to reduce his reliance on fossil fuels and is developing appropriate technologies to meet this ends. In terms of the social

dimension Mr Topping is keen to see the (re)development of a sustainable community and feels that Glenhope Native Forest has a role to play in this through the provision of employment and recreational opportunities. In terms of the social/ economic dimension the forest resource base has increased, both in terms of opportunities and area (through regeneration), since he has been managing the forest. The resource based that he will pass onto future generations will be at least as large and in better condition than he received it. In terms of the economic dimension of sustainability Mr Topping admits that the business has in the past sometimes floundered. In fact, twice he has had to close the mill and seek work elsewhere. And other times the business would not have survived had it not been for his partner providing assistance via the family farm. Today the business is more economically sound, bolstered in no small part by the recent increases in timber prices. With a recent downturn in wool and meat prices he is able to return the favour and offer the farm support.

While Mr Topping's relationship with his forest appears to be well developed in terms of the six (sub)-dimensions of sustainability and all dimensions appear to be well integrated, at least in part, it is recognised that there are weaknesses within the system. Much of it is still a concept or a plan of the direction in which he wants to head. His contour track system is in the initial development phase and the continuous use of his horses is not proven. While he has a range of products which are derived from the forest, the range is not as large as he might like and sales are variable. The Glenhope "community" is disjointed and transient. Enterprising people are often difficult to locate and harder to get to stay. Ecological monitoring is mostly based on anecdotal evidence and observation. While dramatic environmental changes can be readily registered small incremental changes, which may be as critical, are less easily perceived. Political whims and legislative changes and restraints also put the sustainability of Glenhope Native Forest at risk.

Despite these problems in my view Toppie has a sound philosophical base and a good working understanding of sustainability and that he is on the right path to

"achieving" it within Glenhope Native Forest. How far he has gone down that path the author is not at liberty to say, that is up to the reader to decide. However, it would be fair to say that his operation is more sustainable that the plantation forest adjoining Glenhope Native Forest and at least as sustainable as Kahurangi National Park.

Toppy's system of management appears to be closer to a European near natural forest management system than anything recognisable out of a New Zealand tradition. Rather than simply seeing his forest as just a timber resource he has also recently begun to think more about the so called 'minor products' and 'unmerchantable' timber within the forest. He has started to focus away from the middle part of the merchantable species, between the roots and branches, and has begun to look at the so called non-merchantable parts of merchantable species as well as 'non-merchantable' species. This approach appears to be similar to approaches of forest dwellers of some indigenous cultures around the world. The results may have interesting implications both for biological and cultural diversity of people in New Zealand and their relationship with indigenous forests as well as the evolution of a uniquely New Zealand indigenous system of forestry; one which has similarities to the European tradition but also to those of indigenous cultures but is more holistic in thought and hopefully sustainable within a New Zealand context.

6.0 Policy, Legislation and Research

6.1 Introduction

When European settlers arrived in New Zealand they introduced a whole new set of attitudes, values and aspirations which they brought with them [Shepard, 1969]. They projected these attitudes onto the both the indigenous forest and indigenous people often with disastrous consequences. Certain myths were created in order to dominate over and subjugate the indigenous rather than attempting to understand it. Some of these myths[1] became enshrined in official policy and legislation. They have been perpetuated through time and now are often accepted as truth. It is argued that many of these 'untruths' still lay hidden today in policy, legislation and research efforts and they actively serve to hinder progress in terms of sustainability and indigenous forestry.

This first part of this Chapter *Indigenous Forest Policy* traces the evolution of indigenous forest policy and deconstructs and exposes these myths in the process. It is argued that with these myths exposed an indigenous forest policy should be then able to be developed which will help people involved in the industry to move towards sustainability. This deconstruction necessarily requires a degree of generalisation and the limitations of generalisations are acknowledged. It is accepted that there will be exceptions to the rule as all people are not the same.

The second part of this Chapter *Legislation* examines the Forest Amendment Act, 1993. It takes a look at the three mechanisms which have been developed in order to achieve "sustainable forest management" and discusses their strengths and weaknesses. Recommendations are then made what are considered to be improvements on the Act.

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[1] Myth is used in this sense not to mean that something is 'untrue', rather it refers to something which is accepted as truth without being questioned. Without this questioning through time it becomes accepted as truth.

The third part of this Chapter *Research* examines the past and recent research efforts in light of the previous sections and suggests improvements to the existing programme.

The chapter examines policy, legislation and research involving the utilisation of indigenous forests. It is acknowledged that developing parallel to these policies were another set of other policies which called for and in many cases secured the preservation of indigenous forests. While these are seen as important this chapter confines itself mainly to policies involving the utilisation of indigenous forests.

6.2 Indigenous Forest Policy

This section is divided into three part for analysis. The first is an investigation into the history of indigenous forestry policy in New Zealand. It documents changing attitudes to the New Zealand indigenous forests (particularly the utilisation of them) and how these attitudes were reflected in policy. The second part is a look at recent indigenous forest policy initiatives (if in fact there is one) and the third part makes recommendations on a indigenous forest policy in New Zealand.

The first part of this chapter traces the evolution of indigenous forest policy, legislation and research in New Zealand and exposes a number of myths about indigenous forest which have been perpetuates through time. It is concerned, in particular, with the reasons behind the attitudes to the utilisation of indigenous forests and the policies which ensued from these attitudes. While it is about exposing certain 'untruths' it is not a wallow in the folly of those who have gone before us and the deliberate and unintentional destruction they caused; the purpose is ultimately reconstructive. The chapter makes use both of the theory of Postmodernism and of the reconceptualised model of sustainability. However, the model is not used as an analytical framework as it was in Chapter 5.

6.2.1 History of Indigenous of Forest Policy

When the first humans arrived in Aotearoa over one thousand years ago from East Polynesia they discovered a land untouched by humans. The natural resources of this new land would have been not only bountiful but would have appeared limitless. While they undoubtedly exploited the forest resource the extent of this modification appears to have varied from location to location. Small clearings were made for village sites and the growing of crops and trees were felled for construction purposes [Masters *et al*, 1957]. The most extensive modification and reduction in forest area occurred on the eastern sides of the main two islands. Part of this reduction was due to a change to a markedly drier climate between AD 800 and AD 1000 and subsequent stress on the forest [Masters *et al*, 1957; Fleet, 1984; Halkett, 1991]. Volcanic activity caused some fires in the North Island, however, it also appears that 'Moa Hunters' may have been responsible for burning some areas particularly on the dry eastern side of the Southern Alps. [Halkett, 1991; McKelvey, 1995][2].

Much of the reduction in the forest cover appears to have occurred during the early centuries of Polynesian habitation [Mason, *pers com*, O'Regan in Ralston, 1994]. In later times, during the period of the 'classical' Maori a virtual state of balance was reached and the rate of deforestation stabilised [Masters *et al*, 1957; Fleet, 1984]. Possibly with the demise of the moa it may have became unnecessary to burn off the forests (although some areas were still kept clear for crops and bracken fern). Certainly "*in the time of the classical Maori the forest was one of two 'food baskets' (the other being the sea)... It was in the tribes' interests to preserve the forest and fire-raising was traditionally regarded as a punishable anti-social act*" [Fleet, 1984; Best, 1942]. This dependence on the forest for food,

[2]There is some debate over the cause of the reduction in forest loss over the thousand years previous to the arrival of Europeans. Some [ie Masters *et al*, 1957] put it down almost entirely to climate change. Other, particularly the more recent authors [ie McKelvey, 1995] do not mention the climate change and put it down almost exclusively down to the activities of the early Polynesians and Maori. Tracing these references proved to be fruitless as conclusive evidence does not exist.

medicines and timber along with an increasing population and a subsequent depletion and loss of some natural resources led to the development of a number of resource management philosophies and techniques. These first indigenous forest 'policies' in Aotearoa appeared in myth and ritual and were developed to ensure that society stayed within the limits imposed on them by their environment [Ali Memon and Wilson, 1993; O'Regan in Ralston, 1994; Mason *pers comm*, 1994]. It could be said that the relationship which developed between the Maori and their natural environment was thus one of co-evolution. Each adapted to the other until a steady but still dynamic equilibrium was reach, albeit a delicate one.

The arrival of Europeans some two hundred years ago introduced into New Zealand a whole new set of attitudes, aspirations and values. Without the knowledge system and conservation principles which had necessarily been developed over one thousand years of settlement they viewed the forest in a somewhat different light. The Maori personified the forest as Tane and themselves as the children of Tane. "*According to Maori practice and ritual, each tree was as much a child of Tane as each person, with a right to existence and an indwelling essential nature. Therefore, if human beings wished to make use of a tree, an agreement must be reached with the spiritual world, and the felling and working of the timber must proceed with care*" [Nairn, 1983, p9]. This is not to say that the Maori did not use the forest and it products (the use of them was crucial to their survival) but they were well aware of its limits and managed it as such [Ali Memon and Wilson, 1993]. In contrast, the Europeans did not construct the forest in this way. Rather, they saw the forest as an almost inexhaustible resource to be exploited [Roche, 1987; Ali Memon and Wilson, 1993], probably in much the same way as the East Polynesians had viewed Aotearoa's natural resources many centuries before. Without moral restrictions the new settlers began to strip the timber and the legends from the forests [after Wilkinson, 1975]. "*The settlers squandered the children of Tane without respect: one estimate suggests that over half of the kauri in the North was lost to fire while still standing, and with it went thousands of associated timber trees of noble age and stature*" [Nairn, 1983, p9].

"The 19th Century settlers set to clearing "the bush" with gusto, burning it, preventing regrowth, and turning former forests into farms and towns. It was a necessary adjunct to "taming" the Maori" [Horton, 1995]. The indigenous forests, like the indigenous people were seen as something to be feared and subjugated over rather than understood. In Wilson's [1992] research in the Catlins area he found that the attitudes amongst the settlers towards the forest were those of fear. Further, these feelings of being 'engulfed', 'closed in' and 'submerged' by the forest were important driving forces for the creation of open ground beyond the need to clear the forest for simply economic survival[3].

Subjugating the forest was not easy. The forest which was easy to burn had already succumbed to climate change and fire over the previous centuries. Their attitude to the forest, as they tried to carve a piece of pastoral 'Home' out of the 'bush', was essentially one of distaste [after Wilkinson, 1975]. The forest was seen as an impediment to settlement and a hindrance to economic 'progress' [Fleet, 1984; Roche, 1987; Ali Memon and Wilson, 1993]. Progress was defined of in terms of pastoralism rather than forestry. Much good wood was never milled because vast areas of forest were destroyed by fires which sometimes burnt for weeks on end [Fleet, 1984]. Their attitude to the forest is supported by the language used by the settlers. While the forest was personified as a deity by the Maori the settlers called the forest 'bush' (though a bush it hardly was) and where it grew back 'scrub'. These were not terms of endearment. They served to deny the legitimacy of the indigenous forest as a genuine forest type and ease any guilt associated with its domination [after Wilkinson, 1975].

The indigenous forest was not seen in a wholly negative light, however. The timber value of the forest was recognised by the Europeans early on. Not only did they use the timbers to construct houses but the timber of northern kauri forests was found to be well suited to naval purposes [Fleet, 1984; Roche, 1987; Halkett,

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[3] Wilson [1990], however, also found that generally the desire of landowners in the Catlins area to clear forest diminished over successive generations as clearance became an issue of economic necessity, the area of forest diminished and a respect for the small remaining pockets of forests grew.

1991]. By the 1840's pit-sawing timber and the kauri spar trade had become major economic concerns [Fleet, 1984; Halkett, 1991; Ali Memon and Wilson, 1993]. However, some officials were beginning to question the length of time before they felt the resource would be exhausted. This prompted the British Navy in 1841 to propose a series of forest areas to be reserved for future purposes. This suggestion was opposed by the British Colonial Land and Emigration Office on the grounds that it would 'lock up' the land and impede the progress of settlement. Some areas were reserved, by Governor Hobson, but the difficulties in policing the reserves together with the prevailing attitude championed by the Emigration Office made it impractical. According to Roche such land settlement goals functioned to retard the process of forest management and set the trend for the remainder of the nineteenth century [Roche, 1987]. The indigenous forest policy during this period was almost singularly one of deforestation and clearance.

Some efforts were made to control timber extraction from the mid-1840's through a system of timber licence regulations. "*This was the first system of forest management to be introduced into New Zealand by Europeans*" [Roche, 1987, p12]. (T)*he major thrust of the new regulations*, however, *was towards protecting the rights of the timber cutters and controlling the industry rather than conserving the forest resource*" [Roche, 1987, p23]. Like the former efforts of Hobson to reserve areas of forest for utilisation, for the most part, this conservation project similarly failed. The impracticalities of policing the regulations, ambiguities in the regulations themselves and the conflicting attitudes of some of the administrators and the people working in the 'bush blocks' all served to stifle any real forest management efforts beyond 'mining' the resource for short term gains.

By the mid-1860's concern was mounting about timber licensing regulations and how they were actually encouraging a rapid depletion of the forests through wasteful practices. The Superintendent of the Canterbury Province wrote of the timber licences that "(t)*hey give men the right to go anywhere through the forest and to cut and destroy any quantity of timber*" [cited in Roche, 1987, p39]. A few foresters trained in the Anglo-European tradition, however, argued that the

indigenous forests could be treated as a renewable resource and even managed on a sustained yield basis; most notably Captain Inches Campbell-Walker (the Conservator of Forests from 1876 to 1877) [Fleet, 1984; Roche, 1987]. Campbell-Walker was particularly disturbed about the waste and damage to the forest. Their ideas of were not widely accepted, however. The conventional wisdom of the time continued to prevail; that the indigenous flora and fauna of New Zealand was inherently 'weak', lacked 'vigour' and like the Maori would be ultimately displaced by the 'stronger' exotic variety [Roche, 1987; Wilson, 1992; Ali Memon and Wilson, 1993]. "*The displacement concept* (had) *enjoyed widespread support in the 1850's and 1860's when it gained scientific backing in the form of a Darwinian perspective*" [Roche, 1987, p15].

Despite this widespread belief the government of the day felt something had to be done about the impending 'timber famine' [Ali Memon and Wilson, 1993]. In 1873 a Bill was tabled in the house for the preservation and growth of timber on crown land. The Bill, supported by Premier Julius Vogel, "*sought to achieve the efficient exploitation of forest resources*" [Roche, 1987]. The Bill was vehemently opposed by a number of politicians on the grounds cited earlier; ie that the flora was inherently 'weak' and any conservation of it hindered progress and settlement. The Bill did appear in a watered-down version in the New Zealand Forests Act 1874 and Campbell-Walker was appointed as the first Forest Conservator. However, the Act was later repealed the following year and Campbell-Walker's contract was not renewed.

In 1887 the Lands Act was passed with provisions for the acquisition of reserves for purpose of 'the growth and preservation of timber' as well as the protection of rivers and catchments and their associated water values. This Act was more successful in the acquisition of land than the Forest Act and by 1881 over half a million acres had been gazetted as timber reserves [Roche, 1987][4]. On the other hand the Lands Act 1877 also actively encouraged the clearing of forest. Under

[4] The Lands Act 1877 was the predecessor to a number of other conservation and preservation Acts which where to pave the way for New Zealand extensive national parks and reserves network.

provisions in the Act in order for a mortgager to qualify for reduced fees for the purchase of Crown lands he or she was required to make "*substantial improvements of a permanent character*" on the land. Such improvements included the clearing of 'bush' and 'scrub' and paradoxically (though not surprisingly) they also included planting of exotic trees or hedges [Department of Lands and Survey, 1887, p*xxvi*].

Similarly, from the mid-1890's the official and popular answer to production forest management focused on the growing of exotic trees as the best way to overcome an impending 'timber famine'. Anxiety over the depressed state of the timber industry, burdened by excessive plant cutting capacity and limited supplies eventually lead to the appointment of a Timber and Timber Building Industries Commission [Roche, 1987]. Their recommendation was that the government should make more use of indigenous timber for public works in order to relieve the depression in the timber industry [Roche, 1987]. It is suggested that the market was actually over-supplied with timber rather than suffering shortages as had been implied by the impending 'timber famine'. Fleet [1984] also makes comment of a timber glut during the 1900's. The oversupply of timber is further supported by the vast amount of trees which were burnt during land clearance as there was no local market for the timber [Halkett, 1991]. Paradoxically, however, people were prepared to grow sheep meat and wool even thought he local market for these products was also limited.

In 1913 another Royal Commission of enquiry was appointed; this time on Forestry. While Roche comments that the Royal Commission of Forestry was set up out of a concern for the forests it is apparent from their initial brief and the conclusions they reached their concerns were actually for the future of the sawmilling industry. Their main recommendation was; "*It may be stated as a broad principle that no forest land, except it may be required for the special purposes of climatic or scenic reserve, and which is suitable for farmland, should be permitted to remain under forest if it can be occupied and resided upon*" [cited in Halkett, 1991]. Further they estimated that at the current (1913) rate of

depletion the supply of timber would be exhausted in thirty years and that a massive programme of plantation forestry using exotic pines would be required [Roche, 1987; Halkett, 1991].

This general aversion by the Commission of Forestry to indigenous forests management did not go unnoticed by international forestry experts. Two British foresters Sir William Schlich and David Hutchins questioned the supposed inferiority of indigenous forests particularly on the grounds of the so-called 'evidence' for their slow growth rates. A crude analysis of the mathematics (see Chapter 6.2.4) suggests even with the slower growth rates of indigenous trees, compared with the exotics planned to replace them, if they were managed on a sustained yield basis this would have been sufficient to avoid a 'timber famine'. While Hutchins, in particular, started a brief resurgence in interest in the management of indigenous forests this was overshadowed with an unprecedented focus on exotic afforestation by the State Forest Service from 1925 on [Roche, 1987].

The State Forest Service was set up in 1919 following the State Forests Amendment Act of the same year. The Act allowed for land to be set aside for State forests for both conservation and utilisation purposes. The first Director of Forestry was Leon MacIntosh Ellis a forestry graduate from Canada who also had experience in French forests. He strongly advocated improved efficiencies in the forestry sector. He discouraged wasteful logging practices and encouraged the utilisation of trees during land clearance rather than burning them. He also introduced new timber royalty and sales policies designed to make more efficient use of the forests [Halkett, 1991]. Because of the increase in recreational use of the forests at the time a policy, which was later to become to be known as the 'multiple-use' concept, was introduced [Ali Memon and Wilson, 1993]. This policy was based on the assumption that scenery preservation, recreation and production forestry were compatible. Another important objective was also introduced by the State Forest Service; that was the principle of sustained yield management [Ali Memon and Wilson, 1993]. "*Multiple-use management and sustained-yield*

indigenous forestry became the twin pillars of the State Forest Service" [Tilling, 1992, p8].

During the 1920's under Ellis and Cockayne some elementary research commenced looking into the ecology and scientific management prospects of the indigenous forests and how to effect sustained yield. While the findings appeared to be positive compared with earlier expectations[5], Halkett [1991] described the lack of any major initiatives in indigenous forest management as 'disappointing' particularly considering the "*tremendous contemporary activity in plantation forestry*" [Halkett, 1991, p94]. With the onset of the Depression during the early 1930's both the experimental work on the ecology of the indigenous forests as well as work on improving their management came to an end. In stark contrast, however, a massive programme involving unemployed men on relief work schemes planting exotic pine plantations was undertaken [Fleet, 1984; Tilling, 1992].

This was government policy and not necessarily the strategy preferred by the staff of the Forest Service, however. In fact the Director of Forestry A D McGavock in 1934 questioned the wisdom of such extensive exotic planation schemes and warned against too a heavy reliance on exotics and called for a national policy for the management of indigenous forests [Fleet, 1984]. Not only were his calls not heeded but in 1936 the government introduced a price control on rough-sawn timber purportedly to keep the price of houses affordable to the 'common man'. This measure did not only not work, (as most of the cost of a house is not in rough-sawn timber) but it kept the stumpages of indigenous timber low. This manipulation of the economics of indigenous forestry actively discouraged sustainable management as uneconomic and continued to encourage timber 'mining'. "*The persisting ethos of the 'primacy of settlement' meant that the*

[5] While Halkett's [1991] research indicates that during the early 1930's the prospects for the sustainable management of indigenous forests were promising in contrast Tilling [1992] and Ali Memon and Wilson [1993] findings suggest almost the opposite. Ali Memon and Wilson claim that "*The new scientific evidence suggested that the sustained management of indigenous forests was more difficult than initially anticipated*" [Ali Memon and Wilson, 1993, p104]. Tilling said that the initiatives were largely ineffective.

government was still not willing to consider long-term policies for indigenous forests on land suitable for agriculture. Marginal lands were still clearfelled rather than managed on a sustained yield basis" [Ali Memon and Wilson, 1993, p105].

According to Halkett [1991] the trend of 'mining' the indigenous forests carried on through the Second World War as the extra demand created for timber by the war accelerated logging. "*Any thoughts of a more considered approach towards the management of* (indigenous) *forests were largely shelved and supporting the war effort took priority*" [Halkett, 1993, p95]. After the war the Forest Service re-embarked on a very modest indigenous forest management programme. Some tending of second growth kauri and beech forests proceeded and the selective logging of rimu was proposed [Halkett, 1991]. However, the high post-war demand for timber severely hampered any indigenous forest management and forests continued to be clear-cut.

The post-war period saw a sizable increase in mechanisation within the industry in order to decrease waste and improve efficiency. Not surprisingly most of the modernisation occurred in the mills handling exotic species [Fleet, 1984]. The indigenous once again assumed the position of the 'poor cousin'. In 1953, according to the Annual Report of the Director of Forestry as much as two-thirds of the original wood from indigenous forestry operations was wasted. According to the report if a ten percent increase in utilisation was achieved this would have resulted in an extra 20 million board feet production per annum [Fleet, 1984]. Obviously the indigenous forestry industry also needed to be modernised for increased efficiency, however, the prevailing 'mining' attitudes and perceptions carried through from the previous century did not encourage investment.

Throughout the 1950's and 1960's the Forest Service's indigenous forest policy "*included the conversion of indigenous to exotic - the clearfelling of indigenous forest and the replacement by an exotic forest - particularly as machinery, spraying and burning methods proved economically feasible*" [Fleet, 1984, p133]. The Forestry Encouragement Act came into being in 1964 and a subsequent

Amendment in 1965. These two Acts introduced various forestry loan schemes to encourage planting. These loans only applied to exotic plantations; once again the indigenous missed out.

A number of government sponsored land settlement schemes operated in the post-war period. These also tended to be detrimental to indigenous forests in that they served to subsidise the clearance of indigenous forests or regeneration indigenous forests in order to convert them to farmland [Ali Memon and Wilson, 1993]. From the early 1970's onwards subsidies both for land development and increasing stock numbers for farmers were also introduced. This move encouraged farmers to clear forested or scrub-land, often located on land only marginal for agriculture [Wilson, 1992; MAF, 1993]. It is not clear how much forest was sprayed with herbicide and burnt but according to Ministry of Agriculture and Fisheries [1993] an increase of nearly 10% in the establishment of new pasture occurred during the 1970's with a peak of nearly 350,000 hectares being brought into new pasture in 1982. Some of this undoubtedly replaced indigenous vegetation including forest.

6.2.2 Policy Initiatives 1970 - 1984

In the early 1970's the Forest Service began to face strong criticism from the emerging environmental movement. The environmental lobby objected strongly, not so much to the concepts of multiple-use and sustained yield management *per se* but to the New Zealand Forest Service's interpretation of them. While the intent of the Forest Service's concept of multiple-use was to balance the commercial, non-commercial (essentially recreation, water and soil conservation values) and social (employment) functions of the forests in decision making, according to environmental groups, timber harvesting always seemed to get priority [Tilling, 1992].

The introduction of the Forest Service's proposal known as the Beech Scheme on the grounds of 'sustained ecosystem management' appeared to epitomise their

concerns. The scheme intended the clearfelling of over 85% of the indigenous forest deemed to be merchantable on New Zealand Forest Service land in the South Island[6]. This represented some 339,500 hectares of forest of which over 75% were to be converted or 'enriched' with exotic pines and eucalypts. The remaining 25% of was to be regenerated back into indigenous forest[7]. The rationale for such a large-scale scheme was to enable the rapid growth of chip and pulp industries which could later be supplied with logs from the faster-growing exotic species [Searle, 1975; Fleet, 1984]. Despite the rhetoric the scheme appeared to be more about sustaining a timber industry than sustaining forest ecosystems.

Initially the scheme was questioned by the Nature Conservation Council on the grounds that the success of such a scheme was unproven given the small amount of research which had been carried out on indigenous forest management or the ecological effects of such a proposal[8]. Others, however, vehemently opposed the scheme on moral grounds [Fleet, 1984]. While they did not necessarily object to small-scale sawmilling for the local market they were against a scheme which would create a massive industry with similar scale environmental externalities simply to supply an overseas market with disposable commodities [Searle, 1975].

Partly as a response to concerns raised over the Beech Scheme the Forest Service decided to develop an indigenous forest policy (IFP) for lands under its control. The draft was prepared by the Forest Service during 1973-74 and in November 1974 was presented to a specialist working group to study. The group included members from the government, industry, conservation and Maori interests. The group's report suggested some changes to the draft which were later incorporated into the final IFP which was presented to government. The IFP was finally

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[6] This is not to say that all the staff in the New Zealand Forest Service were enamoured with the idea; a number were clearly not.

[7] Percentages derived from Thompson [1971].

[8] The Soil Conservation Authority, the Forestry Development Council and The New Zealand Institute of Foresters later also expressed similar concerns raised by the Nature Conservation Council.

approved by the government on the 20th of October 1975. The policy document was considerably comprehensive with the main policy statement being;

> "***The objective of management of State Indigenous forests shall in general be to perpetuate indigenous forests both as natural forests and as managed stands***" [Froude *et al*, 1985].

It appears that the Forest Service not only sought an IFP which was ecologically sustainable but the inter-disciplinary nature of the group suggests that they sought an IFP which would also be politically and socially sustainable. Treasury however felt that the policy lacked economic rationale because of what they saw as an inevitable reduction in production. Treasury tried at first to change the emphasis of the policy. The document was revised to include

> "***but having regard to the current economic situation and the need to restrain government expenditure***" [Halkett, 1991].

Treasury was not satisfied with this rephrasing and they were also concerned with the expenditure connotations of the policy. In the end the additional funds which the Forest Service felt were essential to implement the policy ($470,000) was essentially reduced to $150,000 [Halkett, 1991]. This according to Halkett made it exceedingly difficult to implement the policy promptly and effectively.

Overall the IFP re-emphasised the multiple-use concept, endorsed the need for logging techniques which were "*economic, environmentally acceptable, and compatible to management aims*" [cited in Fleet, 1984, p154] but continued to focus on timber supply (as may have been expected from Treasury directives). However, to the consternation of the environmental lobby the policy continued to see indigenous forests as a legitimate source of land for settlement or exotic plantation forestry and clearfelling continued [Tilling, 1992; Ali Memon and Wilson, 1993]. The Environmental Council reviewed the IFP in 1977 and gave it a lukewarm assessment.

In the mid-1970's the Forests Amendment Act 1976 was passed. This Act "*made provisions for more public input into forest policies. Environmental criticism could now be voiced at a more political level*" [Ali Memon and Wilson, 1993]. This was another signal that, like the development of the IFP, the Forest Service was prepared to include some public participation in their policy process. Decisions about the utilisation of New Zealand's indigenous forests (on public land) could now begin to have a social rationale rather than a being driven predominantly from a scientific economic rational which favoured 'enrichment' and 'conversion' of the 'inferior' indigenous forests to the 'superior' exotic plantations[9].

Despite this move, the Beech Scheme idea continued to be aired by the Forest Service. In 1977 a petition opposing the scheme and declaring that the logging of indigenous forests should be phased out by 1978 was presented to parliament. The Maruia Declaration, as the petition was known, was signed by 341,160 people. This essentially signalled the end of any ideas of a large-scale beech scheme. Throughout the late 1970's and early 1980's the environmental movement (sometimes even backed by other government agencies such as the Wildlife Service) disputed with the Forest Service over its IFP; of particular note was its logging in the Pureora State Forest and the burning of indigenous forest in the Buller area [Fleet, 1984]. This further entrenched the environmental lobby who by this time were pushing for a total end to the harvest of **any** indigenous forests, whether on a sustainable basis or otherwise [Ali Memon and Wilson, 1993][10].

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[9] This is not to say that all scientists and foresters supported these policies, but this is predominantly where the funding was directed.

[10] The conservation movement in New Zealand started formally in 1915 with the formation of a New Zealand Forest and Bird Protection Society. Its aim was "*to awaken public interest in the value both economically and aesthetically of our birds and forests*" [cited in Fleet, 1984, p115]. Not only were they concerned about conservation for preservation but they acknowledged the importance of conservation for use. The Beech Scheme as well as strengthening the organisational structure of the conservation movement, also served to polarise much of it. Conservation for preservation now became their overwhelming message.

6.2.3 Recent Policy Initiatives

A major shift in policy direction occurred as a result of the election of the Fourth Labour Government to office in 1984. "*Economic efficiency, cost cutting and user-pays became the orders of the day*" with the introduction of monetarist economic policies[11] under Labour [Tilling, 1992, p11]. Treasury identified economic inefficiencies it saw within the State forest sector. It put these 'inefficiencies' down to a lack of clear, non-conflicting objectives within the Forest Service; under its 'multiple-use' 'pillar' the Forest Service was a provider of both economic and non-economic goods. When Treasury released its recommendations to split the commercial and non-commercial functions of the New Zealand Forest Service the move had widespread support amongst the environmental lobby. They felt that the Forest Service could not be entrusted to conserve the indigenous forest estate because from recent experience development kept being placed before conservation. Further, they believed that the activities of the Forest Service served to subsidise the timber industry[12] [Ali Memon and Wilson, 1993]. So in 1987 forest lands which were deemed to be suitable for preservation purposes came under the control of the Department of Conservation in 1987. A further 164,000 hectares of indigenous forest was allocated for utilisation purposes to the newly formed Forestry Corporation; the majority of which was later vested in a state owned enterprise called Timberlands West Coast Ltd.

Farm subsidies were also removed in 1984 by the Labour government. According to research carried out by the Ministry of Agriculture and Fisheries [1993] the felling of native forest for the conversion to farmland "*has declined substantially thus reducing the loss of habitat for indigenous flora and fauna*" since the removal

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[11] Monetarist economics was popularly called 'Rogernomics' after the architect of the reforms, the then Minister of Finance, Roger Douglas. "*'Rogernomics' fostered the removal of subsidies, removal of protective barriers, deregulation of industries and services, removal of government intervention in the management of the nation's commercial business, and expose of the business sector to free market conditions*" [O'Loughlin, 1992, p151]

[12] This situation was not helped in any small part by the existence of price controls on timber for virtually all but the last few years of the New Zealand Forest Service's existence. These price controls were fiercely fought against by the Forest Service itself it might be added.

of subsidies [MAF, 1993, p11]. The loss of indigenous forest still continued on private land, however, despite the cessation of farm subsidies. Wilson [1992] cites the example of indigenous kamahi/ rata/ rimu forest on private land in the Catlins being clearfelled for the Awarua chipmill near Invercargill. The deal often struck involved the chipmill clearing the forest free of charge and in return the farmer received a track and an increase in pasture. However, from the interviews carried out by Wilson in more than 80% of the cases the land was left in a 'mess' unsuitable for grazing.

By the mid-1980's the environmental movement was becoming increasingly articulated, politically informed and influential. This was partly a result of campaigns fought over the Forest Service's indigenous utilisation policies particularly since the Maruia Declaration with protests concerning Pureora, Whirinaki, Paparoa and Waitutu forests [Ali Memon and Wilson, 1993]. From the mid-1980's to the early-1990's three Forest Accords were agreed upon between the forest industry and environmentalists, amongst others (the government has also been a signatory to the first two Accords) in order to avoid further conflicts over indigenous forest utilisation.

The 1986 West Coast Forest Accord and the 1989 Tasman Accord both contain voluntary policies which obligate the industries involved to end the clearfelling of indigenous forest and move to an exotic plantation resource through a transitional programme. The transitional arrangements were agreed upon for the sake of both the forest industries and the communities which depended upon forestry. These Accords have been relatively successful at setting common goals amongst all parties and moving towards them. It has not been all smooth sailing, however. Disagreements have arisen within the West Coast Forest Accord on at least two occasions. The first was the extension of the "transition period" allowing the continued clearfelling of rimu forest. This extension was the subject of 'bitter controversy' both on the West Coast and nationally [Horton, 1995]. The second was the award by Timberlands West Coast of the milling rights for most of their annual rimu harvest to one company, Westco-Lagan, at the expense of other

sawmills on the West Coast. This called into question the West Coast Forest Accord's commitment to the employment needs of those on the Coast, particularly in relation to an equitable distribution of an increasingly scarce resource [van Beynon, 1994]; an issue of intragenerational equity.

In 1991 the New Zealand Forest Accord was agreed to by members of the forest industry and a number of environmental groups[13]. This Accord acknowledged both the importance of plantation forests for easing the pressure on the harvest of natural forests and the importance of indigenous forests for their heritage and conservation values. It attempted in particular to address the problem of old growth and regenerating indigenous forests from being cleared for exotic plantations. It also committed those signatories in the forest industry to move towards the sustainable management of indigenous forests for "*the production of added value solid wood products in New Zealand*" [New Zealand Forest Accord, 1991]. This Accord has been relatively successful at keeping the industry to its word as is backed up by their stance on the East Coast Forestry Project involving Ngati Porou and Tasman Forestry. Under the terms of the Accord, Tasman Forestry were restricted from clearing kanuka forest in order to plant *Pinus radiata*. The definition of kanuka forest was contested by Forest and Bird and a consensus could not be reached. According to Tasman Forestry if they accepted Forest and Bird's definition the economic viability of the project would have been substantially reduced [Horton, 1995]. Rather than break the terms of the Accord Tasman Forestry regarded it as more prudent to withdraw from the project. While this outcome demonstrates the power of the Accord the social and economic outcomes have not been satisfactory for both Ngati Porou and Tasman Forestry [Parliamentary Commissioner for the Environment, 1994].

The approach which has been adopted by all of these Accords appears to have met with more success than previous attempts by government to shape an indigenous forest policy. The approach is integrative, in that it seeks include a variety of

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[13] Greenpeace New Zealand, New Zealand's largest environmental organisation, did not sign because they saw exotic plantation forestry as inherently unsustainable [Horton, 1995].

perspectives and rationalities. The approach also appears to continue to move away from the notion that only two options are possible for indigenous forests; that is, they exist **either** as a non-renewable resource to be exploited until exhausted **or** as a non-exploitable resource to be 'locked up' as a piece of Nature to be passively admired[14]. The New Zealand Forest Accord accepts that indigenous forests have an intrinsic value which has to be respected and not automatically subjugated over by the economic value of the exotic plantations. It creates opportunities for the indigenous forest to assert itself and exist alongside the exotic. On the surface it appears that these Accords are working relatively well, although there will be expected arguments between the parties concerned because of their disparate standpoints.

It has become apparent there are two main problems with the Accord approach, however. The first is that not everyone in the industry, and not all environmental and social groups with an interest in indigenous forests, are signatories [Ansley, 1995]. Those in the industry who are signatories to these Accords are almost certainly genuine with their intentions. It is those who operate outside of these Accords and continue with a pioneering mentality like the early Polynesians and early Europeans before them. A recent case involved MRGC NZ Ltd (jointly owned by American companies, Merrill Ring and Green Crow Corporation) and a 2738ha property called Manuka Island near Nelson Lakes National Park. The property was almost entirely covered in kanuka/manuka forest (also containing a significant amount of kowhai (*Sophora* spp.) and cabbage trees (*Cordyline* spp.). The project, which was to be roller-crushed and planted in exotic pines was approved by the Marlborough District Council. The natural forests were once again subjugated.

Another problem is that even those who are signatories to these Accords are not legally bound to abide by them. In highly publicised cases, such as the East Coast Forestry Project involving Ngati Porou and Tasman Forestry, it is in the public relations interest of the forestry company involved to abide by the Accord. In other

[14] This is not to say that preservation does not have a role, it clearly does.

cases the incentive to abide by the agreement may not be so strong. A case in point involves Earnslaw One, a Malaysian company, and its purchase of a 4,400 hectare Gowan Hills farm in Southland[15]. The subalpine vegetation is almost entirely indigenous though only small patches of it could be defined as forest (mainly small hardwoods). The intention of Earnslaw One is to plant the entire property in Douglas fir. The pre-planting programme included the spraying of these small patches of hardwood forest with herbicide. Under the Accord the spraying of this type of vegetation is restricted. Although it is obvious that the Accord was breached, because it is relatively small scale, the violation goes virtually unnoticed. While the infringement may appear to be relatively minor it is suggested that the small areas of hardwood may play an important part in the functioning of the local ecosystem[16].

While it has been identified that a problem with the Accords is that they are not legally binding, such a situation is possibly one of the Accords' strengths. In the opinion of the author if the Accords had have been made legally binding it is unlikely that any would have been agreed upon at all. The problem is to find ways in which to hold all parties to the agreement in a non-threatening way and avoid defections from the Accords.

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[15] Gowan Hill farm contains approximately 500 hectares of silver beech forest which is managed for production purposes. Gowan Hills Trust holds the cutting rights over this forest and was one of the case studies selected by the author for analysis (though the case study does not appear in this thesis).

[16] For example, these small areas of hardwood forest contain species such as *Griselinia littoralis, Carpodetus serratus, Pseudopanax simplex, Myrsine divaricata, Podocarpus hallii* and *Hoheria glabrata*. All these species have fruit. While the size of these areas is relatively small it is speculated that their function as a food source for birds is significant. Further it is speculated that a reduction in this forest type will not only affect the size of the population of birds which feed on these species but will also affect the small population of New Zealand Falcon which reside in the area.

On Monday 12 March 1990 an indigenous forest policy was announced by the Labour prime minister, Geoffrey Palmer. The policy stated that

> "(t)***he objective of the*** **(indigenous forests)** ***policy is to maintain or enhance, in perpetuity, the current area of indigenous forest, either by protection, sustained yield management or reafforestation of native species***" [Prime Minister's Office, 1990].

While simple in its construction this policy statement was the first time an indigenous forest policy had been announced which covered the utilisation of indigenous forests on both public and private land[17]. It led to the formation of a bundle of policy instruments in order to meet this objective including an export ban on indigenous logs and woodchips, the creation of a number of forest protection measures and in 1993 an amendment to the Forests Act 1949 to encourage sustainable management of indigenous forests. One year after this policy announcement the Resource Management Act 1991 (RMA) also came into being. The RMA also called for the sustainable management of all resources including forests. The RMA was the first piece of legislation which attempted to control clearfelling of indigenous forest on private land [Wilson, 1991 cited in Ali Memon and Wilson, 1993].

The export ban which was announced with the indigenous forests policy statement, originally covered indigenous woodchips, logs and sawn timber. The only exemptions were "*where production is from an area managed under a certified sustained yield management plan*" [Prime Minister's Office, 1990]. The rationale for an export ban was to try and stop the large scale clearfelling[18] of indigenous

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[17] Labour's indigenous forests policy was published in an expanded form in a discussion document *A Forest Policy for New Zealand*. The document contained both indigenous and exotic forest policy proposals and called for submissions. Of interest here is that although Labour had announced their indigenous forest policy some five months previously when it came to print it was actually a **proposed** policy rather a policy which had received official approval from the Cabinet.

[18] Between 1981 and 1988 7000 hectares of forest had been clearfelled in Southland for the Awarua chipmill [Hackwell, cited in Horton, 1995].

forests, particularly of beech in Southland and Nelson, which was mainly being chipped for export. A $20 million fund was established (later increased to $28 million) to compensate forest owners for the loss of economic opportunity. While the intention of the policy initiative was sound, in practice it can really only be considered to have failed. The fund only paid the forest owners to postpone logging until July 1992; after this date they could continue to clearfell. Also when the National Government came to power they authorised two "trial shipments" of woodchips, which later increased to four and (by 1994) to nine [Horton, 1994][19]. There are many ironies in regards to the indigenous woodchipping in New Zealand. Amongst them, the first is that the construction of both the chipmills in Nelson and Southland were subsidised by the government. Secondly, the forest owners received a pittance for the logs taken[20]. Thirdly, in 1990 the Hunt Foundation (who owned the Awarua mill) were placed into receivership, never having paid a dividend to their shareholders. And lastly most of the public believed that the 'export ban' along with compensation paid to the forest owners meant the end to clearfelling [Horton, 1995].

As a result of Labour's policy announcement two new funds were established to encourage voluntary agreements with landowners on the protection of indigenous forests [Prime Minister's Office, 1990]. These were the Forest Heritage Fund and Nga Whenua Rahui (Nga Whenua Rahui targets Maori land). A total of $10.3 million/ year was made available by the government to negotiate covenants and purchase blocks of privately owned forested land. Land which is purchased by the Crown is then managed by the Department of Conservation for preservation purposes. Despite, Labour's commitment to "sustained yield management" neither of these funds is able to assist landowners who want to utilise their indigenous forests on a sustainable basis. While these funds seek to sustain the ecological values of these forests they do not provide for long-term economic and social opportunities which many of these forests are perhaps capable of providing. The

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[19] The nine shipments represent about one thousand hectares of forest.

[20] In 1977 landowners in the Nelson area were paid $1 per tonne (Topping *pers comm*). In 1994 the rate in Southland was $30 per tonne (Mac Donald, *pers comm*).

means stated to achieve the indigenous forests policy was through protection, sustained yield management or reafforestation. To date, one hundred percent of the money allocated by the government for assistance with the policy has gone into protection. Further, forest owners who wish to manage their forests for sustained yield management (or reafforestation) not only do not qualify for assistance but with the introduction of the Forest Amendment Act 1993 they are burdened with additional administration costs. (The Forest Amendment Act 1993 is covered in depth in section 6.3)

6.2.4 Exposing the Myths Surrounding Indigenous Forests

Since the arrival of Europeans to these shores the attitude and treatment of things indigenous to this country has generally been one of aversion and domination. This has been characterised by a lack of understanding of the indigenous and a fear of the unknown. The exotic/ indigenous dualism was supported by the myth that the indigenous people and 'their' forests were inherently weak; they lacked the vigour of the exotic and would invariable die out. The myth that the inferior would eventually be displaced by the superior enjoyed widespread support gaining scientific backing. It served to exterminate both the "wild knowledge" associated with these forests along with the forests themselves. Rimu was reduced to red pine, kahikatea to white pine, and matai to black pine. These trees were stripped of their romanticism down to their bare boards. The forests were further furnished with the terms 'scrub' and 'bush'; to call them forests would have accorded them a reverence the early settlers did not have for them.

Despite this general aversion to indigenous forests, there were flurries of interest in the management the forests as a renewable resource rather than a 'mining' activity; most notably Campbell-Walker and Vogel in the mid-1870s, Hutchins in the late 1910s, Ellis and Cockayne in the early 1920s and the New Zealand Forest Service particularly in the 1970s. Unfortunately their efforts came to little in terms of managing indigenous forests for production purposes even on a small

scale. The predominant view that indigenous forests were 'weak' continued to hold popular appeal and was perpetuated through time. Despite some scientific evidence to the contrary, this idea supported the notion of 'primacy of settlement' and spurned a number of myths about the indigenous forests. In this section a more detailed discussion of these myths is delved into and what the effects of the perpetuation of them will probably be.

The first assessment of the indigenous forest resource was carried out between 1868 and 1869. The survey concluded with a forecast that New Zealand's forest resources would be exhausted in anywhere between three years and four hundred years varying on the local supplies. This was to set a trend and from then on virtually all forest surveys gave an estimation of how long the forests would last until they were exhausted (see Figure 12). Without exception they were wrong. This was even before exotic plantations played a part in the timber industry. While carried out with good intentions such surveys only served to reinforce the idea that these forests were a timber 'mine' and thus reinforced the myth that they were non-renewable. Rather than asking the question 'what is the sustained yield of these forests?' it was assumed that the exhaustion of these forests was inevitable and it was a matter of working out when this date would be.

The myth that the indigenous forests were non-renewable led to the creation of another myth; that of an impending 'timber famine'. In 1925 (the year that the first wave of large-scale plantation forestry began at Kaiangaroa) the Forest Service estimated that between 2 and 2.2 million hectares of available merchantable indigenous forest existed in New Zealand[21]. If this total area was managed on a sustained-yield basis (assuming a mean annual increment across all forest types in New Zealand of 2.5m3/ha/yr) this would have yielded in the order of 5 and 5.5 million m3/yr. To put this in perspective in 1956 New Zealand required 3 million m3 of roundwood for its domestic requirements and in 1995 we required just under 5 million m3 [MoF, 1993; MoF, 1995].

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[21]In 1909 the official estimates of millable forest was estimated at 17,074,003 acres (or approx. 6.9 million hectares.

Year	Source	Duration of Timber Supplies	Exhaustion Date
1868	AJHR	3-400 (depending on locality)	
1872	Hay	50	1921
1874	Firth	30	1904
1877	Campbell Walker	40	1917
1878	Kirk	30	1908
1879	Armstrong	25	1904
1879	Peppercorne	20	1899
1874	Hector	20	1893
1905	AJHR	70	1975
1907	AJHR	<70	pre 1975
1908	AJHR	50	1958
1909	AJHR	35-40	1945-49
1913	AJHR	30	1943
1925	SFS	40-45	1965-1970
1955	NFS	20-30	1975-1985

Figure 12. Official Estimates of Timeframe for Exhaustion of Indigenous Timber Supplies. AJHR = Appendices to the Journal of the House of Representatives. SFS = State Forest Service. NFS = National Forest Survey. (Sources Fleet [1984], Roche [1984], Ali Memon and Wilson [1993].

While increment studies have shown that between 1.5 m3/ha/yr and 2.0 m3/ha/yr are common in virgin podocarp forest [Beveridge and Franklin, 1977], mean annual increments of between 5 and 9 m3/ha/yr are common in red beech forest with occasionally up to 10m3/ha/yr being recorded in 70 - 80 year old stands [Wardle, 1984; Tinley, *pers comm*]. The other species of beech show similar growth rates though this varies depending on site conditions. A high percentage of the 833,000 hectares of indigenous forest available and suitable for production purposes today is beech forest. Therefore, an average mean annual increment of only 5.6 m3/ha/yr over all these forests would be required in order to provide New Zealand with sufficient timber to meet its domestic needs on a sustained yield basis today. While the author's interpretation of the figures may be disputed, the

main point is that it was unlikely that a 'timber famine' would have arisen if our indigenous forests had been managed on a sustained yield basis at most any time in the past. Further, if all the available indigenous forests available today were managed on a sustained yield basis they could probably still supply all our domestic needs and possibly have some left over for export. The evidence seems to support the idea that an eminent 'timber famine' was a myth.

This leads onto another common myth about New Zealand's indigenous forests. In 1913 the Royal Commission on Forestry dismissed the idea of retaining indigenous forests for long-term timber management on the grounds that "*without exception the* (indigenous) *timber trees are of much slower growth than those used in forestry operations .... and therefore are unsuited to forestry purposes*" [New Zealand Report on the Royal Commission on Forestry, 1913 cited in Froude *et al*, 1985]. The Commission perpetuated the myth that indigenous forests are slow growing and need to be converted to exotic to have any real value for forestry. In order for forests to be managed for timber purposes it is not a prerequisite that they grow fast. In Europe, with its well established forestry tradition, some forests are managed on a 200 year rotation, with rotations of 80 to 120 years being common [Kuusela, 1994]. In this context New Zealand's forests are not especially slow growing; particularly its *Nothofagus* forests. John Wardle has found for example that the growth rates he is achieving in his black beech forest near Oxford, Canterbury are such that he able to manage his forest on a 48 year rotation. He feels that the growth rates through management are beyond his expectations and that on some sites the rotations could be reduced to as little as 37 years [Wardle *pers comm*, 1994]. A survey carried out by the Forest Research Institute [Pardy *et al*, 1992] of private indigenous forests also supported Wardle's conclusion. It found "*that timber production from well tended plantations is possible in 50 - 60 years for some species such as the beeches, kauri and totara*". It is surmised that if the type of genetic selection and engineering work which has gone into *Pinus radiata* had been applied to indigenous species the growth (and form) of these species could possibly also have been 'improved' upon.

The myth that indigenous forests were a relic of a past era, inherently weak and prone to die out in the near future has been an underlying theme in many discussion papers on indigenous forest management. For example Gover [1995] says that one of the main traditional constraints to the development of an indigenous forest industry has been the 'inherent pathogen problems' of the indigenous species. Such an argument was "*used widely in the 1970's by the New Zealand Forest Service to support 'exotic enrichment' and 'exotic conversion' of indigenous forests (eg Conway, 1977)*" [Ali Memon and Wilson, 1993, p101]. It is argued that this 'inherent pathogen problem' is more a problem of a lack of understanding of the ecology of the indigenous forest as well as a lack of understanding of the preferences of a diverse society. The cause of the apparent 'weakness' is not an innate feature of these ecosystems and timbers which are derive from them. It is more a result of a policy of continued and deliberate subjugation by humans of these forests, particularly in the first few hundred years of Polynesian occupation and the first few hundred years of European/ Pakeha occupation. In fact, Dr John Wardle points out that New Zealand's forests are actually very resilient; they have had to be. They have evolved in a land, whilst devoid of browsing mammals, has been subject to extremes of climate, unseasonal weather patterns and volcanic and tectonic forces which have built and eroded mountains [Wardle *pers comm*]. While the recent introduction of mammals has undoubted affected the indigenous forests it is, in the opinion of the author, the policies of consecutive governments which have favoured the 'primary of farming' and the 'primacy of exotic species' which have reduced the forests to small remnants in some areas.

These myths were created in the pioneering days to serve a world view based on rationales supporting a 'primacy of settlement' standpoint. The development of both an affinity to and an appreciation of an increasingly familiar land has in general led to a change in attitude toward New Zealand's indigenous forests. It is argued that many of these myths that were created in the early days of European settlement, have been perpetuated through time and are still with us. While these myths served the purposes of our ancestors it is argued that they are not only

inappropriate as we search for sustainability in indigenous forests but they actively serve to hinder its 'attainment'. For sustainability to be 'achieved' in New Zealand's indigenous forests these myths and their assumptions need both to be questioned and exposed. If not it appears we are destined to continue to look for the right answers to the wrong questions.

6.2.5 Summary

Using Barbier's reconceptualised model one could position the 'classical Maori' near if not within the shaded area of sustainability. Over time they had come to understand the biophysical processes of Aotearoa, developed technology to exploit the resources without over-exploiting them, took into cognizance future generations as well as the present ones, and developed myths and rituals to hold this understanding together as they moved towards the integrated shaded area of sustainability in the centre of the model. They became indigenous to this land and its forests as if they were part of it [after Weaver, *pers comm*].

When the Europeans arrived in Aotearoa they were unfamiliar with the new land, its people and its forests. This lack of understanding lead to fear and subjugation of the indigenous people and forests. They brought with them the attitudes and power of Western science and religion. They introduced their own world view and plants and animals to the new land in order to feel comfortable and be able to survive in it. While their attitudes may have been appropriate in the places they had come from, in the new land they created conflict, both within the indigenous people and the indigenous resources. For perhaps the first one hundred years of European occupation the European would have been located on the firmly on the periphery of the model particularly within the economic dimension as the land was 'tamed'. The Maori in contrast began to away from the centre of the model as the social, economic and biophysical reality which they had known and co-evolved with seemed to have less importance and relevance.

Over time, however, the Europeans began to develop an affinity to an increasingly familiar land. They began to appreciate the indigenous things of this country. 'Home' became a place up the road and not 12,000 miles away. While the Europeans had similar world views when they first arrived over time these diverged. Some people seemed to be content to hang onto the pioneering values which their ancestors brought with them while others developed quite different values. Some saw the indigenous forests as a resource which should continue to be exploited, while others saw the forests as something worth preserving. The extremes of the two world views positioned themselves firmly in the 'opposite' camps. Those who tried to bridge the gap and move closer to sustainability such as Campbell-Walker in the 1870's, Ellis in the 1920's and members of the Forest Service in the 1970's found themselves ostracised by both the development and preservation camps.

In a recent book Ali Memon and Wilson confirmed that the myth that indigenous forest are inherently weak is alive and well. "*On the basis of current scientific knowledge, the opportunity for sustained yield timber production in indigenous forests does not appear very feasible for ecological and economic reasons. Compared to other mid-latitude forests, the delicacy of the New Zealand forest ecosystems and their vulnerability to external impacts is a major constraint on logging*[22]" [Ali Memon and Wilson, 1993, p116].

It is argued both the preservation and development views about indigenous forests are based on the same myths. It is also argued that the continuation of these myths is the greatest obstacle to movement in the direction of the elusive shaded area of sustainability. **In order for a meaningful indigenous forest policy to be developed the myth that indigenous forests are inherently weak (and the other associated myths) have to be exposed**. To continue to hang onto these myths will probably continue to result in either one of subjugation or preservation for New Zealand's indigenous forests. Only when these myths are

[22] The evidence by the likes of Dr John Wardle and Peter Topping who are successfully managing their indigenous forests for timber and other products suggests otherwise. They have found that the regenerating beech forest grows like 'weeds' and rapidly invades disturbed sites.

exposed will the preservation/ development dichotomy be broken and can we begin to move towards 'achieving sustainability' with regards to our indigenous forests.

6.3 Legislation

On the 1st of July 1993 an amendment to the Forests Act 1949 passed into law. It joined a list of recent natural resource legislation with a focus on the concept of sustainability. The Purpose of the Forest Amendment Act, 1993 is "*to promote the sustainable forest management of indigenous forest land*". The Amendment applies to privately-owned indigenous forests, only. It does not cover the Crown's West Coast forests managed by Timberlands West Coast Limited, land permanently reserved under the South Island Landless Natives Act 1906, Department of Conservation land or any planted indigenous forest. The area of land covered by the Amendment is still significant, however. It encompasses some 1.3 million hectares [Ministry of Forestry, 1993]. This is slightly more than New Zealand's entire exotic forestry estate, though probably only around 50% of this is potentially capable of sustaining production of indigenous timber [MoF, 1993]

The Amendment attempts to promote sustainability of privately-owned indigenous forestlands through three mechanisms. Firstly, it places a prohibition on the export of certain indigenous forest produce; particularly wood chips and logs in an unprocessed form [Section 67C, Forests Act 1949]. The rationale for this move was both to stem the flow of indigenous timbers out of New Zealand and to provide for employment opportunities within the country. Secondly, the Amendment requires sawmills cutting indigenous timbers to be registered with the Ministry of Forestry [Section 67D, Forests Act 1949]. Any timber cut by these mills must be sourced from forests with Ministry of Forestry approved sustainable management plans. Special permission may be gained from the Ministry for timber from other sources to be milled. The third mechanism by which the Amendment promotes sustainability is through the requirement that indigenous forests from which trees are harvested are subject to management plans approved by the Ministry of

Forestry [Section 67E, Forests Act 1949]. These management plans are registered against the title of the property and generally operate for a term not less than fifty years.

To lessen the negative economic impacts of the legislation on forest owners and sawmillers who were dependant on the pre-1993 conditions for their economic survival "transitional regulations" were introduced. During this transitional period forest owners were entitled to cut a restricted amount of timber through a permit system while at the same time this gave them an opportunity to proceed with the preparation of management plans. Sawmills, once registered, could qualify for an "allowable cut" during the four year transitional period (1993 - 1996) equivalent to the amount they had cut in the previous two years [Baddeley, 1993].

In this section each of the mechanisms in the Forest Amendment Act 1993, designed to promote sustainability, are analysed for their strengths and weaknesses. In light of nearly three years in operation the legislation is then analysed overall to assess how it is working (or not working).

6.3.1 Export Controls

The export ban [Section 67C] was one of the more controversial parts of the Forest Amendment Bill. Some argued that an export ban would be beneficial as it would protect remote, steep terrain and low volume forests from being logged. Without an export ban it was feared that high international log prices would make it viable for helicopter harvesting to take place in such areas [Forest and Bird, 1993]. Others argued that an export ban would prevent low impact sustainable management from being economically feasible by artificially depressing the price of logs and prevent land owners from gaining revenue off of forested land [Maruia Society, 1993]. On reflection, neither of these outcomes has eventuated and it is unlikely they will do so.

The forests which Forest and Bird describe are typical of montane forests. These ecosystems are generally well represented in New Zealand and contain low species diversity and merchantable timber volumes [Wardle, 1984]. As such, these forests are rarely sought after for their timber values and are probably those in least need of protection. As far as an export ban on logs affecting the viability of sustainable utilisation of indigenous forests is concerned, this has probably not eventuated to any great degree either. It has been acknowledged that forest owners will probably receive the highest price for timber domestically [Topping, *pers comm*]. This is because New Zealanders are more likely to pay a premium for these timbers, due to their historical and cultural significance to us, than probably will do international buyers who are often able to source substitutes from where labour is cheaper and environmental standards often lower. As the supply of New Zealand's indigenous timbers becomes tighter through the expiration of the transitional provisions and the value for them grows in the domestic market place, it is increasingly becoming apparent that the viability of sustainable management of these forests is more dependant on the domestic market than access to the international market.

It has been suggested that a measure which may be more relevant to the sustainability of these forests could be a ban on the import of cheaper substitutes, in particular those substitutes which originate from "unsustainable" resources in developing countries [MacDonald, *pers comm*; Heath, 1992]. It has been claimed because of the lower environmental standards in these countries such substitutes tend to keep the price of New Zealand's indigenous timber down and negatively affect the viability of sustainable management in New Zealand [MacDonald, *pers comm*]. Difficulties may arise with such a restriction being perceived as a protectionist trade barrier under the GATT agreement [Beder, 1993]. Such a position may not be possible to legislate without contravening this agreement. This may also have economic repercussions for the people in the countries where these timbers are sourced. If a holistic solution is sought, a better (or more sustainable) solution may be to educate these people to the benefits of sustainability within their own forests rather than devaluing their resource base through restricting

their markets. For sustainability to be a viable proposition the value of products must increase in order that low impact methods, which invariably cost more than high impact methods, are able to be afforded.

The strength of the export ban is probably greatest in terms of its implications for the social and economic dimensions of sustainability rather than its ecological implications. An export ban should ensure that little unprocessed timber leaves New Zealand. A scenario where most indigenous timber was exported or attained international prices outside that of the reach of average New Zealander would be a regrettable situation indeed. It would also be regrettable if New Zealanders did not have the choice of buying timber which had not been treated with chemicals such as preservatives, pigments or adhesives or have the ability to buy timber products which they feel they have a cultural attachment to.

An export ban should ensure that neither of these situations arises. Retaining the raw product in this country should encourage the maintenance and further development of a cultural identity between New Zealand's unique indigenous timbers and the people of this country. In turn, this should foster a desire to protect our forests not only for preservation purposes but also for purposes of utilisation. By having access to an assured supply of these timbers and an incentive to process them locally their qualities will become more appreciated as people use them more extensively, particularly timbers such as the beeches whose potential has, in the past, not been fully appreciated. The skills that are required by sawmillers and craftspeople to utilise these timbers should, likewise, be encouraged to (re)develop. The qualities of many of these timbers are felt to be inferior and/or unproven [Topping, *pers comm*; Wardle, *pers comm*]. A situation has arisen whereby today there are few sawmillers who can properly cut many of our indigenous timbers; particularly the hardwoods [Topping, *pers comm*; Wardle, *pers comm*]. By retaining the raw materials in New Zealand an export ban may help to redress this predicament.

If any industry is to develop at all in New Zealand based around the export of

indigenous forest products, this will necessarily require additional processing in this country. Such processing should add value to the finished product and supply a greater number and range of economic and employment opportunities than if the product was sold unprocessed. Such export industries should also be stimulated to develop in the knowledge that they can rely on a continuous supply of raw products because relative certainties of the sustained yield management system.

In terms of biophysical sustainability, by retaining the processing of these products in New Zealand we are also in the best position to monitor and mitigate the effects which these industries may have. For a product to be "truly" sustainable it must be sustainable throughout the whole of its life, not simply a part of it; in this case from the forest to the production of the final product and beyond. With an export ban we are not able to relinquish the responsibility offshore for any negative environmental effects which processing may bring. In other words we have to "look after our own mess" rather than place the responsibility for this on others in other countries who may not have ethics, resource management laws and practices as stringent as our own.

The main weakness of the export ban on indigenous logs and wood chips is that it is probably not necessary. The international price of New Zealand's indigenous timbers is generally not high[23]. This was born out by the fact that the volume of unprocessed timber (logs) and partly processed timber (sawn timber) leaving the country prior to the Amendment was negligible in relation to the supply to the domestic market[24]. A restriction on the supply of logs, which other parts of the Amendment has helped bring about, has seen the domestic price of indigenous timbers rise steadily thus making New Zealand perhaps the most attractive market. Without a ban on the export of wood chips market forces would probably have also worked against the chip market; the reduced supply increasing the value of logs to a stage where it would not be economically rational sense to chip them.

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[23] There are exceptions to this, for example swamp kauri in the Japanese niche market.

[24] In the ten years prior to 1993 the amount of native timbers exported averaged 3.8% of the total cut; the range being 2.0 - 6.7% (New Zealand Forestry Statistics, 1993).

Chipping of wood tends to make more sense with a high-volume, low-value product. This is how the indigenous forest resource was treated in the past even those logs with little or no "defect" [Falloon *et al*, 1991]. Today the situation is rapidly changing as the price of indigenous timbers increases and the emphasis shifts to a low-volume, high-value product.

However, it has also been argued that the export ban on wood chips has been detrimental in that it affects the ability of forest owners to get rid of their low grade wood fibre [Heath, 1992; Heath, 1993; Flight in Hutching, 1992]. The ability of forest owners to sell low grade material, it has been claimed, may be the difference between making sustainable management of indigenous forests an economically attractive or, alternatively, marginal activity. This is particularly so in areas where there is a high occurrence of low grade or non-timber species. Heath [1993] cites the example of kamahi forest in the Catlins area which were in the past able to be chipped. He claims that many farmers will now view these forests as a liability because of rating and pest control requirements. He says that they will now tend to clear "low grade" forests in favour of pasture or exotic species or "high-grade" their forests for sawlogs under the guise of sustainable management.

This argument is somewhat flawed in that although a prohibition applies to the export of wood chips there is nothing to prevent a the supply of wood chips to a wood-chipping plant for use in the domestic market. It is also flawed in that the Ministry of Forestry should be astute enough to recognise signs of high-grading in forest owners' practices and take measures to prevent it happening (as long as they have sufficient funding). Heath's argument is also based on land-owners acting only on rationalities which are financially driven. In fact, people are often motivated by things other than money and may enjoy and be prepared to conserve indigenous forest on their land for other reasons apart from purely economic. It could also be argued that the wood chip export ban has tended to make forest owners think of more creative ways in which to deal with their low grade wood and "non-target" species. Apart from firewood, this "low grade" wood is

increasingly being used by people for craft purposes and other uses such as roofing shingles (red and hard beech) and landscaping feature pieces (roots and stumps).

6.3.2 Sawmill Controls

The major strength of the sawmill control portion of the legislation is that it places part of the responsibility for the sustainability of indigenous forests on the sawmiller rather than leaving the onus wholly on the forest owner. As stated previously the whole system must be sustainable, not just a part of it to be "truly" sustainable. It is expected that this legislation should go some way in helping sawmill owners realise that the issue of sustainability does not begin and end in the forest; they also have a responsibility. The initial reaction of many sawmillers to the new legislation was negative as they felt that a control on the supply of indigenous logs and an increase in administration required under the Amendment was unnecessary [Flight in Hutching, 1992]. Now that they are beginning to realise the benefits to their businesses of sustainability, such as an assured long-term supply of logs[25] and higher prices for timber, it is predicted that their support for the legislation will increase. Sawmillers should then take a greater interest in the conservation of indigenous forests and their products and be in a better position to take advantage of long-term business and capital investment opportunities.

Another strength of placing controls on indigenous timber at the sawmill, rather than simply on the forest owner, is that by having two points in the system which are being monitored by the Ministry of Forestry makes discrepancies in records and activities of both the sawmillers and forest owners easier to locate. It is a way of double checking and "keeping everyone honest". Whilst saying this, increasingly the forest owner and the sawmiller are one in the same person. It makes economic sense; particularly as portable sawmills are relatively cheap, they are conducive

[25] However, the drop in total volume of logs has caused some problems locally with some sawmills facing closure [Clarkson, 1995].

to the sensitive management of these forests and the returns on sawn timber is approximately twice that of raw logs [Wardle, *pers comm*]. Consequently, if this part of the legislation is a mechanism to make the fabrication of records difficult it is bound to fail.

A weakness of the legislation with this focus on sawmilling controls is a perception that it is more of a sawmilling Act rather than a forests Act or even a forest owners Act. This perception, by forest owners and the public alike, is fuelled by the fact that under this Amendment practices which could be termed "destructive" activities are still legally permitted to occur within indigenous forests as long as they do not involve sawmilling[26]. Examples are, the clearance of indigenous forest for farmland or exotic forestry or the use of the wood for purposes not involving sawmilling such as for firewood or split posts. Such a focus on sawmill and sawmillers does not necessarily foster a conservation or sustainability ethic within the forest.

6.3.3 Sustainable Forest Management Plans

The part of the amended Forests Act 1949 which relates specifically to forest owners are Sections 67E to 67L, for sustainable forest management plans, and Section 67M, for sustainable forest management permits. These sections of the Amendment require that either a plan approved by the Ministry of Forestry or a permit (generally in the case of small forests or individual trees) is obtained by the land owner from the Ministry in order to harvest and mill indigenous trees. These documents are registered against the landowner's title in perpetuity.

The strength of the sustainable forest management plan requirement is that it sets out the management of the forest in a way which is clear and easily monitored. This has advantages both for the forest owner in the management of

[26] Such activities **may**, however, be restricted under the Resource Management Act, 1991.

his or her forest and the Ministry of Forestry in their role of administering and policing the Forests Act, 1949 and its amendments. While the requirement to produce a management plan can be seen by forest owners as a daunting and often expensive task[27], a management plan can also be viewed both as a useful document for forest management as well as a capital investment. On completion of a management plan the economic value of the forest should, theoretically, increase at least as much as the cost to compile the management plan.

The weaknesses with this system are not so much in the concept of management plans themselves but rather in the legally required content. Traditionally in New Zealand management plans involving natural resources are composed of two parts [ie Catlins State Forest Management Plan, 1977; Kaimanawa Forest Park Management Plan, 1990]. The first part is the resource statement. This is generally a description or inventory of the resource; it describes **what** is physically in the forest in terms of species, soils, hydrology etc. The second part of the management plan is the policy statement. This contains the policies of the organisation or business, including its mission statement, goals and objectives. It describes **how** the resource is to be managed and, just as importantly, the rationalities behind **why** it is to be managed in those ways.

Under the Forests Act, 1949 [Section 67J] (and the guides published by the Ministry of Forestry in relation to this section) the provisions relating to sustainable forest management plans tend to perpetuate the belief that forests are timber and wood products; only "target species"[28] are required to be described for the Ministry of Forestry and these in terms of volume only. Nor are the so called "minor products" (including recreation and tourism), which the forest owner may utilise, required to be included. Forests are more than timber they are also about things such as biological diversity and social phenomena. While biodiversity **may**

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[27] The cost of compiling a management plan can be in the region of $10,000 to $30,000 depending on the size of the forest and the additional information the forest owner wishes to include within it over and above that required by the Ministry of Forestry.

[28] Those species which are at present utilised for timber values.

be required to be monitored, [MoF, 1995a] this is up to the discretion of the Ministry of Forestry. At a recent New Zealand Native Forest Producers Association meeting a number of concerns were raised about the Amendment. One was that the members felt that "(t)*he definition of "Sustainable Forest Management" should include all produce out of the forest*" not just timber [NZNFPA, 1996, p1].

The requirement that both total volume and merchantable volume of trees are recorded also tends to perpetuate the belief that there is such a thing as "non-merchantable volume" or waste. What is non-merchantable from one perspective, however, can be merchantable from another. Today there are forest owners who feel that the whole tree is merchantable; from the leaves and branches down to the stumps and roots of the trees. To them there is no part of the tree which is unmerchantable and nothing that is waste. The concern here is that the way that the resource is described tends to flavour how the resource is constructed in the mind and how it is ultimately utilised or protected. By requiring certain things only this can influence the way the forest owners see their forests and restrict opportunities which may otherwise develop, for example opportunities to utilise "non-merchantable" parts of trees, species other than target trees or for purposes other than timber such as cultural, usufruct[29] or preservation purposes.

As such, the Forest Amendment Act 1993 tends not to legitimise rationalities which are outside that of merchantable volumes and sustained yield. Sustainability is a holistic concept and it is, therefore, imperative that the reasons behind various practices be allowed to be addressed through the use of many rationalities, including both scientific knowledge and "wild knowledge[30]". If these are not then there is the very real danger of falling into the trap of thinking that

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[29] "Minor" products and uses.

[30] "Wild knowledge" is a term first used by Will Wright (1992) and can be described as that knowledge which has been created outside that of Western science and its methods; in this case by people with a working relationship with the forests and a vested interest in its conservation. It is also sometimes described as local knowledge or indigenous knowledge.

sustainability is simply about target species, merchantable volumes and sustained yield.

Perhaps part of the problem may lay with the definition of sustainability within the Amendment. While,

> *"The purpose of this part of this Act is to promote the sustainable forest management of indigenous forest land"* [Section 67B, Forests Act 1949],

where sustainable forest management is defined as

> *"the management of an area of indigenous forest land in a way that maintains the ability of the forest growing on that land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values"*[31] [Section 2, Forests Amendment Act 1993]

and although there is an attempt within the Ministry of Forestry guidelines to encompass a wider definition of sustainability within the main body of the Amendment the focus is undeniably on sustained yield of timber.

> *"The principle sustainable forest management prescription is that the rate of harvest from a forest or a group of forests managed as a single unit shall be limited to a level which the forest can continue to supply an annual or periodic non-diminishing yield in perpetuity"* [Section 10(1), Forest Amendment Act 1993].

Unlike the Resource Management Act 1991, the Forest Amendment Act 1993 does not have a place for rationalities from the social dimension of sustainability. Within the Purpose of the Resource Management Act people, *communities* and

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[31] Note that the definition of sustainable management in the Forests Amendment Bill introduced to parliament was originally *"the management of a forest in a way that maintains its ability to provide products and amenities in perpetuity,* ***while retaining or enhancing the natural ecological process and genetic diversity for the benefit of future generations"*** (Anon, 1992). The references to ecosystems and future generations were later deleted (Forest and Bird, 1993).

future generations are provided for as is their *social*, *economic* and *cultural well being*. The social and cultural values of the forest are mentioned neither in the legislation nor within the Ministry of Forestry guidelines. Of significance is that the Treaty of Waitangi is not part of the Amendment. In other areas of resource management law such as the Resource Management Act 1991 and the Conservation Act 1987 the Treaty of Waitangi plays an integral part. A perception that Treaty rights have been protected through the exclusion of land reserved under the South Island Landless Natives Act 1906 from the Forest Amendment Act [Puentener, *pers comm*] is flawed. Much Maori land is not excluded from the Amendment, but more importantly, there may be other cultural values on privately owned forested land that need to be taken into account within the management and planning process of the utilisation of indigenous forests. It could operate in much the same way as at present under the Resource Management Act 1991. Consultation with iwi is often required when private individuals and public bodies apply for a resource consent to carry out a particular activity.

The Forest Amendment Act 1993 also really only allures to the biophysical dimension of sustainability. While *"retaining the forest natural values"* is mentioned within the Amendment, words that form an important part of the Resource Management Act 1991 such as *water, soil, ecosystems* and *environment* are notable by their absence. The Ministry of Forestry interprets the definition of sustainable management from *"continue to provide a full range of products and amenities"* to include the monitoring of biodiversity [MoF, 1995a]. This is a commendable interpretation, however, products and amenities tend to be associated with human utilitarian values yet biodiversity also includes non-utilitarian values and arguably intrinsic values as well[32]. The Ministry of Forestry also describe biodiversity as "forest description" [MoF, 1995a]. Such a definition may be a function of limited space but biological diversity is much more than simply a description of the forest.

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[32] Shiva (1993) has also stated that biological diversity and cultural diversity are inseparable.

While the Resource Management Act 1991 invariably has its faults its definition of sustainable management is wider and more holistic than the Forest Amendment Act 1993. In the opinion of the author forest owners need to be able to legitimise their activities within the wider context of sustainability for "true" sustainability to operate. A similar (or even the same) purpose as the Resource Management Act 1991 would be a step in the right direction. Forest owners need to be encouraged to and be able to feel that there is legitimacy within their own rationalities for the management of their forests which are beyond those of merchantable timber, sustained yield and scientific knowledge.

One of the main differences between the Resource Management Act, 1991 and previous legislation concerning the management of natural resources is that it concentrates on *"avoiding, remedying or mitigating"* the **effects** of activities, rather than regulating (or prescribing rules for) the activity itself [MoF, 1995b]. Previous resource management legislation tended to place direct controls on land use. The Forest Amendment Act 1993 partly follows suit. It concentrates on regulating the effects of activities [Ali Memon, 1993], however, the activities that are regulated are at the sawmill rather than in the forest. At the forest level the Amendment falls back on earlier resource management legislation and leans heavily upon prescriptions. A number of problems arise because of this, some of which are outlined below.

Under Sections 67M, 67O and 67J (10) the Forests Act 1949 New Zealands forest's are classified into three types ((i) podocarp and kauri, (ii) beech and other light demanding species, and (iii) shade-tolerant and exposure-sensitive broadleaved hardwood species). Their management is then dictated through certain prescriptions according to the category which the forest falls into. Such a method makes two assumptions; it assumes that forests fall obviously into one of the three categories listed and it assumes that conclusive knowledge exists for the "correct" management of the forests within the three categories.

Despite the categories being broad, the complexity and diversity of New Zealand's

forests means that often a forest does not fit easily into a specified category. Clearly any categorisation of natural forests is a scientific construct; it is a simplification of reality to make it easier for us to understand the complexities of the world, but, it is not reality itself. As such beech forests do not exist, though forests with beech trees in them obviously do. Glenhope Forest, for example can be described as a mixed beech forest, however it also contains rimu, kahikatea, matai and totara as well as a host of other plant and animal life. Forests do not exist which fit neatly into the categories.

By pre-prescribing management regimes the Amendment assumes that the knowledge required for the sustainable management of each of these categories is complete and that this knowledge can be universally applied to any forest depending on which category it fits into. For podocarps, for example, the Amendment prescribes single tree or small group harvesting, however, it appears that rimu can grow in cohorts in much the same way that beech tends to do, particularly on the West Coast [Wardle, *pers comm*]. Trees can also behave differently depending on their locations or species associations. Beech trees are described in Section (10)(c) as light demanding. While silver beech could be described in this way in Southland, in Nelson they are most definitely an exposure-sensitive tree often prevalent in the sub-canopy [Topping, *pers comm*]. The Amendment does not take into account the array of associations and diversities of New Zealand's forests nor does it allow or legitimise alternative kinds of wild knowledge or management approaches. Management regimes specific to each forest and appropriate to their individual complexities need to be developed. Prescriptive management regimes, in the opinion of the author, could easily result in the reduction of more complex forest systems to simpler systems, if followed to the letter.

The prescription system dictates, what is done, not how it is done. It, therefore, does not control "unsustainable" activities which may still fulfil the requirements of the Amendment. Already there are examples of management regimes which have been submitted to the Ministry of Forestry and approved which include what

are believed by the author to be "unsustainable practices". The size of the coupes is determined by the Amendment prescriptions but says nothing about how one should select these for harvest. Two examples of this in beech forest were observed by the author where the selection of coupes for harvest is taking place which bear little relationship to the ecology of the natural forest. The size and shape of coupes and the trees selected for harvest are not based on the forest structure or any ecological rationality. These things were determined firstly by the maximum coupe size allowed to be felled and secondly in order to facilitate their removal by helicopter. In each coupe every size of tree was felled which left little in the way of cover for the advanced regeneration (seedlings only). In one instance virtually all advanced regrowth has succumbed to winter desiccation.

Clearly specific prescriptions for the management of natural indigenous forests are not appropriate; there are so many exceptions to the forest classification system, trees can behave in different ways depending on their location and associations, and gaps in our knowledge (and the type of knowledge which is deemed legitimate) make it difficult to prescribe for every situation. General policies (rather than prescriptions), such as Section 10(1) would appear to be more suitable; for example, a prescription that would require a forest owner to as far as possible mimic the processes of the natural forest. In this way a forest owner couldn't get by simply by fulfilling certain mathematical obligations but that he/she would have to try and understand his/her forest in order to prove that he/she was mimicking its ecological processes. This should lead to a greater understanding, by forest owners, of the uniqueness of their forest and, in turn, better management of their forest based on both scientific and "wild" knowledge specific to that particular forest.

6.3.4 Miscellaneous Provisions

A number of indigenous forest owners saw the introduction of the Forest Amendment Act 1993 as an infringement upon their property rights, which was

imposed on them without compensation. It was claimed that they had purchased their land under the understanding that at some time in the future they could utilise the forest upon it for timber and profits [Flight in Hutching, 1992]. This Amendment supposedly reduced the value of indigenous forests to forest owners and prevented them from fully realising these benefits [Flight in Hutching, 1992]. Some claimed that the Amendment would embitter landowners against conservation [Maruia Society, 1993]. It was feared that forests would be cleared by landowners exercising their property rights, either previous to the Amendment for logs or after the introduction of the Amendment for firewood or farmland; under the Amendment clearfelling would in fact accelerate [Heath, 1992]. Immediately prior to the introduction of the Amendment some what was described as "panic" logging did take place[33] [Riddell, 1993; Horton, 1995]. The total number of cases is probably small, however, as other factors will have worked against such a reaction [Baddeley, 1990]. Factors which prevented such outcomes include the high costs associated with land clearance and the conservation ethics of landowners.

While the Amendment does not prevent all harvesting of timber on private land, as many people have come to believe [Rooney, 1995], it does restrict the rate of harvest and legislates against compensation for this restriction. It is probably unreasonable to expect the Crown to compensate landowners for this change, in light of the fact that it is generally accepted in New Zealand law that the rights of private property owners are often attenuated by resource and planning statutes [Hide, 1988]. The value of these forests has in many cases substantially increased since the introduction of the Amendment as the price of timber has risen as much as two-fold in some cases [Topping, *pers comm*]. Such a rise in the value of the asset would probably make direct compensation inappropriate. However, some form of incentive or grant may not be unreasonable for a forest owner to expect to assist in achieving the intentions of the Amendment. If a forest owner wants

[33] Forest owners have also reported more "panic logging" as the end of the transitional period looms by those mills with allowable cut obtained under the Amendment which they have not used yet.

to preserve her/his forest there are a number of mechanisms by which she/he may do so; for example through Nga Whenua Rahui, the Forest Heritage Fund or a Queen Elizabeth II National Trust covenant. Under these mechanisms assistance is often given towards costs associated with fencing and surveying. However, if a forest owner wants to conserve and manage their forest under the Forest Amendment Act 1993 there is no help under this Amendment or through any of the mechanisms above[34]. (Ironically both the Awarua and Nelson chipmills were built with government subsidies yet the government is at present unwilling to offer any subsidies to those who want to manage their forests on a sustainable basis).

Under present conditions it costs somewhere in the vicinity of $10,000 to $30,000 for a forest owner to prepare a management plan for her or his forest depending both on the size of the forest, their level of competency and how much over and above they go in fulfilling the requirements of the Amendment. The other major costs associated with this type of forest management are those involving fencing [Topping, *pers comm*]. Lack of fencing is a major threat to conservation; particularly in forest remnants on farmland. In those areas to which stock have access there is often no understorey or regeneration [Evans, 1983]. It is envisaged that a conservation fund (as distinct from a preservation fund) to help finance costs such as the preparation of management plans and the construction of fences would go a long way in helping landowners care for their forest remnants without completely restricting their use of the forest.

6.3.5 Overall Strengths and Weaknesses

The main strength of the Forest Amendment Act, 1993 is that it makes forest

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[34] The Queen Elizabeth II National Trust is looking with interest to the success (or otherwise) of the Forest Amendment Act, 1993 and may in time introduce a mechanism which may help forest owners wishing to manage their forests under the Act. (QEII National Trust, *pers comm*).

owners aware of and focuses them on the concept of sustainability. Despite the widespread belief that the utilisation of indigenous forests for timber purposes has now ceased, generated partly by the actions of one Mr John Cowan on the West Coast immediately prior to the passing of the Amendment [Riddell, 1993], some people are beginning to think and talk about sustainable management of these forests. The legislation has helped the sustainable management of indigenous forests to be seen both as a feasible option and as an economically legitimate activity. It is not now simply seen as the preserve of a few foresters, scientists and alternative folk. It is beginning to be seen that an option exists for indigenous forests which involves neither their conversion to pines or pasture nor does it require the forests to be "locked up" in reserves for little economic gain to landowners. Some landowners are even seriously considering the possibilities of growing indigenous "forests" and a few have already begun to take the step [Topping, *pers comm*; Wardle, *pers comm*]. Similarly, protecting regenerating bush from stock and fire now has an economic rationale which is now backed up by the legislation. In practice, however, the initial fencing costs and return time on the investment tend to be working against this trend being widespread.

Probably the greatest weakness of the Amendment is that it creates an unlevel playing field; not everyone involved in the utilisation of indigenous forests in New Zealand is playing by the same rules. Forestland reserved under the South Island Landless Natives Act 1906 and Crown forests managed by Timberlands West Coast are exempt from the conditions of the Amendment. An example of this unfairness appear in Timberlands draft management plan for its West Coast beech forests. Firstly they planned to clearfell 7 hectare coupes as of right[35] [36]. Secondly, the state owned enterprise also intends to over-cut its Buller-Karamea forests until the year 2006; that is it wants to remove more volume from its beech

[35] This management schedule effectively expands the coupe size to 21 hectares as Timberlands proposed to harvest three adjacent 7 hectare coupes over a three year period.

[36] Following an environmental audit by the Parliamentary Commissioner for the Environment the recommended coupe size has been reduced to 5 hectares with no harvesting of adjacent coupes until regeneration has become established.

forests per year than the forests' present annual volume increment. Timberland's also feel that Timberland's also believe that they should not have to set aside any areas of forest aside as representative reserves, as the Department of Conservation has done this within its role as an agent of the Crown. Timberlands "*will utilise the existence of the reserve network and good management to ensure an ecologically sustainable option is preserved for future generations*" [Hilliard, 1992][37].

Under the Forest Amendment Act 1993 private forest owners are generally limited to coupe sizes of 0.5 hectare, their rate of harvested is limited to a level at *"which the forest can continue to supply an annual or periodic non-diminishing yield in perpetuity"*, and they are required to set aside as reserve a representative area, of up to 20% of the forest area, which is unavailable for harvesting. Such an unlevel playing field will make it difficult for small private forest owners to compete in the market place with Timberlands West Coast Ltd and Timberlands will have an unfair advantage[38] [Shirley cited in Horton, 1995]. The costs of sustainability are necessarily higher per unit of volume harvested when one is required to abide by the later constraints. Timberlands already have an added advantage in that as the biggest indigenous forest owners they tend to act as and have the economic benefits of a monopoly [Heath, 1992]. As Timberlands steps up production this will affect the economic viability of private indigenous forest owners. The temptation of some private forest owners will be to cut corners in order to stay in business. The ramifications of this will probably be to the detriment of their forests. The public perception is that the days of clearfelling indigenous forests are over [Falloon *et al*, 1991]. Clearly they are not when Timberlands are proposing to

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[37] Under Hilliard's rationale private forest owners who have forests next to or surrounded by Department of Conservation should likewise be exempt from the requirement to set aside areas for non-harvest.

[38] Hilliard [1992] estimates that 0.5 hectare coupes increase harvesting and access costs by 100%.

clearcut large areas[39].

Land reserved under the South Island Landless Natives Act 1906 is exempt from the Forest Amendment Act 1993. Therefore these forests do not have to be managed on a sustained yield basis or have to involve low impact methods. One forest which falls under this description was visited by the author could best be described as a "moonscape". There was obviously no thought for sustained yield and the clearcut harvesting methods used had a very high visual and environmental impact[40]. The economic affect that this has on other forest owners in the area who are required to abide by the Amendment has also been marked. One forest owner spoken to in Southland using sustainable management principles said that his operating costs were about $500/m3 to finished product. This means that for him to make a reasonable profit he has to sell his timber for between $750/m3 and $1000/m3. He said that timber sourced from the "Landless Natives" land sells for between $200/m3 and $250/m3 for the equivalent product. This makes it extremely difficult to be competitive.

6.4 Research

Research efforts into sustainable and silvicultural management of indigenous forests in New Zealand has been sporadic and limited. Ellis was instrumental in starting a research programme in the 1920's, however, it was terminated through lack of funds during the Depression. As was pointed out earlier, however, thousands of pine trees were planted in Kaiangaroa at the same time funding was pruned for indigenous forest research. After World War II there was a small

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[39]Since Falloon *et al* [1991] announced that "the days of clearfelling are over", in reference to indigenous forests in New Zealand over 7,000 hectares have been logged [Horton, 1995] (only which a small proportion has been done under an Ministry of Forestry approved sustainable management plan.)

[40] Another forest visited by the author and also reserved under the South Island Landless Natives Act 1906 was in contrast operated on a sustained yield and low impact philosophy.

amount of research carried out on selection logging systems and 'enrichment' with exotics in cutover areas. However according to Hinds and Reid [1957] the technical side of indigenous forestry was virtually limited to reconnaissance and timber cruising. This trend of very restricted research into indigenous forestry continued up until the 1970's, forty years after large-scale exotic plantation forestry had been established in New Zealand. Such a lack of knowledge was fertile ground for perpetuating the myths about the so-called weaknesses of indigenous forests and their difficulty in management.

In the 1970's The Forest Service and the Forest Research Institute (FRI) embarked on a modest research programme and attempted to implement some of their early sustained yield initiatives from the 1920's and early 1930's [Ali Memon and Wilson, 1993]. Finally in 1979 after repeated calls from the New Zealand Forest Service and others in the industry the timber price controls were lifted. These timber price controls had effectively served to stifle indigenous forest sustained yield management as an economically feasible activity. The price of indigenous timbers were unable to move into a higher price range and pay for any extra costs sustainable management necessarily required. Theoretically by the early 1980's the commitment to research in indigenous forest management should have been supported by an improved economic rationale.

In 1984, the Labour Government was elected to Office and set about introducing its economic reforms. These reforms and the onset of the "user-pays" ideology affected the both the structure and funding of forestry research and development. At FRI (where much of the indigenous forest research was based) the various divisions from 1985 on had to obtain a percentage of their funding from charges made to the commercial sector [O'loughlin, 1992]. While both exotic and indigenous forest research received reductions in their funding, once again indigenous forest management was disproportionably affected in the negative sense. Exotic forest research was able to attracted funding relatively easily as there was a well developed industry willing to pay for the research. On the other hand indigenous forest management had an 'unproven' history and few commercial

customers willing to pay or who could afford to pay for research. O'loughlin [1992] also notes that within the new structure there is an increased emphasis on short-term commercial research within FRI. This is actually an antithesis of what indigenous forest research requires to develop because of its longer time horizons than plantation forests and the lack of previous research which it can build upon. In addition to this, in 1987 essentially the entire funding for the then Indigenous Forest Management Research Field (FRI) was transferred to the Department of Conservation [Pearce and Sadleir, 1992]. The role of the Department of Conservation is the preservation of Nature, however, and it has no mandate to carry out research for utilisation purposes. Therefore, the funding for indigenous forest research once again dried up.

Shortly before the Forest Amendment Act 1993 was passed the Indigenous Forest Unit of the Ministry of Forestry was established. Their primary role is to administer the Amendment and offer advice to forest owners. A very modest research programme has consequently developed in order to ensure that the advice which is being given is sound. A number of problems have been identified with the present research programme, not the least the scale of the programme. At the present time there is a little over 1.3 million hectares of indigenous forest in private ownership and 164,000 hectares owned by the State for utilisation purposes. This represents slightly more in area than the entire exotic production forests put together. Officially there are 2 scientists working in the area of indigenous forest management at the operations level in New Zealand (contracted to FRI). While there may be a sprinkling of others in universities and organisations such as Timberlands this is probably many times the order of magnitude less than those working on research into exotic forest management.

Another problem according to a number of the forest owners who operate under the Amendment is that present research efforts are poorly targeted. The New Zealand Native Forest Producers Association feels that "(t)*here is a concern that there is very little participation by layman in research projects and that scientists take little notice of layman's observations and experience and results of research are*

not made readily available to active practitioners" [NZNFPA, 1996, p1]. The main research projects at present are being conducted on land under the management of Timberland's West Coast. While these projects contain sustained yield and ecological rationalities, they do not necessarily include the social and economic realities and even sustained yield and ecological realities of the forest owners who the Amendment presides over.

The solutions to these problems appear to be obvious; what is required is firstly more funds and secondly research that is well targeted. Within exotic forestry the solution has increasingly involved charging the forestry companies for research carried out [O'loughlin, 1992]. This ensures that research is targeted to needs and that funding of the research is forthcoming. This approach is hardly an option within indigenous forestry (at least in the short-term); many of the forest owners are finding it a financial strain simply getting their sustainable forest management plans together.

At Landcare Research an interesting research programme is being developed by Dr Ocke Bosche and colleagues which appears to overcome some of the fore mentioned problems within indigenous forest research. The programme involves research on South Island high country farms. The research programme is designed by Landcare in consultation with the farmers and is targeted to the farmers problems and needs. As well as production farming, the programme also includes forestry, conservation and tourism on the farms. The farmers are trained by the Landcare scientists on how to carry out data collection, monitoring, etc. The farmers thus become their own researchers as well as being 'research providers' for Landcare. Landcare then analyses the data and relays the results back to the farmer. The advantages of such a research programme are that it is;

1. Cost-effective.
2. Well targeted to the needs of the farmers and therefore the knowledge is useful to the farmer.
3. Takes cognizance of the farmers' realities and "wild knowledge".

4. Ideally it is about communities solving their own problems.
5. Facilitates research uptake.
6. Offers an educational experience.
7. and is Adaptive.

The greatest obstacle to implementing such a programme is the cost involved in purchasing a computer system which is powerful enough to collate and analyse the data. It is not suggested that the same system be adopted for an indigenous forest research programme. However, the advantages of the Landcare research programme listed above could be used as guidelines.

6.5 Recommendations

6.5.1 Policy

In August 1990 a document called *A Forest Policy for New Zealand* was published by the Ministry of Forestry. It declared that there was a need for a national forest policy, suggested thirteen desired outcomes for such a policy and called for submissions for input into the policy [MoF, 1990]. The document followed on from and included an expanded version of Labour's indigenous forest policy in located in Outcome 2 of the document. The process was never completed, however, and no final policy document was ever published.

Recommendation 1

That the policy process for indigenous forests be completed. The draft policy document includes both exotic and indigenous forests. From this research it is concluded when the exotic and indigenous are placed alongside each other the indigenous in the past has virtually always lost out. In the opinion of the author those involved in the policy process need to be aware of this and be prepared to redress this imbalance. They also need to aware of the myths and attitudes which

have created and perpetuated this imbalance. This **may** require separate policy documents for exotic and indigenous forests, however, such a move would have the potential of polarising the two rather than integration which is also necessary.

Recommendation 2

That programmes to assist and encourage forest owners who wish to become involved in the sustainable utilisation of indigenous forests be developed. At present there are a number of mechanisms to assist landowners who wish to protect their forests, such as Queen Elizabeth II National Trust covenants, the Forest Heritage Fund and Nga Whenua Rahui. However, there is no assistance offered to landowners for the conservation of indigenous forests for utilisation purposes.

6.5.2 Legislation

The recommendations pertaining to the legislation, ie the Forest Amendment Act 1993, are made in light of the three initial case studies chosen for analysis, four other forests visited, literature which has been reviewed and the discussion which has ensued. It is acknowledged, however, that if a legislation review was to take place it would most definitely take a wider scope with a greater focus on public consultation, participation and process than can be carried out within the limitations of this thesis.

Recommendation 1

That the Treaty of Waitangi and its principles be recognised as an integral part of the Forests Act as it is in most other resource management legislation in New Zealand today such as the Conservation Act 1987 and the Resource Management Act 1991.

Recommendation 2

That a wider definition of "sustainable forest management" be included in the Forest Amendment Act 1993. Ideally this definition would encompass at least the six dimensions of sustainability identified in the reconceptualised of sustainability (see Chapter 3). It could take the form of, or perhaps even be the same as, the definition of sustainable management as contained in the Resource Management Act, 1991. Such a narrow definition as at present only serves to legitimise a few rationalities concerned with the sustained yield of merchantable trees. Other resources both physical and intrinsic need to be included in and legitimised through the definition of "sustainable forest management".

Recommendation 3

That a so-called 'level playing field' be created whereby all indigenous forests in New Zealand are covered by the same legislation. The Forest Act needs to include Timberlands West Coast forests, the forests reserved under the South Island Landless Native Act, 1906 and Department of Conservation stewardship areas as per the Conservation Act 1987[41]. The rationale behind including Department of Conservation lands would be so as to keep the option of sustainable management of these forests in the long-term, probably very long-term, open to such a time when philosophies and practices have developed to an extent which are both ecologically and socially acceptable, and to give the Department a vested interest in the sustainable management of New Zealand's forests as a stakeholder.

Recommendation 4

That in the drafting of any new legislation the focus be on sustainable management practices and philosophy ***within*** *indigenous forests, rather than on sawmills or export controls.* Controlling the activities of sawmillers and exporters will probably have a marginal effect on the destruction of native forests and associated ecosystems. Under present legislation indigenous forests are still able to be

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[41] The Department of Conservation lands suggested for inclusion in new legislation for sustainable forest management would not include land in national parks, maritime parks, refuges, sanctuaries or reserves or conservation areas outside of stewardship areas.

clearfelled for firewood, pasture or exotic forestry. Another avenue for the further reduction in the area of New Zealand's indigenous forest is that the Act allows a permit to be gained for the removal of salvage timber, ie *"timber from trees that have fallen naturally"*. Forest edges which have been "accidentally" burnt or where trees have died through overstocking **may** potentially become available for logging. "Unsustainable" activities may also able to be carried out as long as forest owners meet the prescriptions required by the Ministry of Forestry.

Recommendation 5

That the legislation recognises that the best from of protection of indigenous forests on private land, for those who wish to utilise their forests, is through education and economic incentive. Legislation which has a side-effect of reducing the economic value of indigenous forests to owners should be avoided so that conversion to pines or pasture does not become the more economically attractive option for landowners. The export controls should be monitored for the affect they are having on the price of logs and sawn timber to the landowners and steps taken if they are proved to be negative. The possibility of assistance to forest owners should also be investigated and a mechanism implemented if deemed necessary.

Recommendation 6

That the present sustainable management prescriptions are repealed from the Forest Amendment Act, 1993 and a new set of policies developed. The first prescription included in Section 10(1) could be kept as a policy. That is that "*the rate of harvest from a forest or group of forests managed as a unit shall be limited to a level at which the forest can continue to supply an annual or periodic non-diminishing yield in perpetuity, which yield shall include the harvest of windthrown or dead trees as they become available*". This clause should be extended to include all forest products which are utilised or harvested not just timber.

Other more general policies could be developed, to replace the more specific prescriptions. For example, one which requires forest owners to understand the

forest dynamics and natural processes of their forest and build this into their management system may be more appropriate. This is essentially the purpose of the present prescriptions, however, a more general prescription would compel the forest owner to gain a greater understanding of her/his particular forest and the affect of their activities upon the forest in order to prove that their proposed management regime was biophysically sustainable rather than simply meeting the requirements of a set of prescriptions.

6.5.3 Research

Recommendation 1

Develop a research programme which addresses the needs of the indigenous forest owners who are affected by the Forest Amendment Act 1993. Not withstanding significant increases in funds to carry out additional research, present research initiatives need to come from and be targeted to those who require the information the research could provide. It appears that forest owners who come under the Forest Amendment Act 1993 are in those most need of research, therefore, the research initiatives should come from them to be effectively targeted.

Recommendation 2

Develop a research programme which takes into cognizance the many and varied rationalities of forest owners. At present the research which is being carried out focuses on forest management. It would be desirable to have an expanded research programme that considers other dimensions of sustainability in order to encompass these other rationalities, whether economic, social or biophysical, whether scientific or 'wild' knowledge. However, it is also acknowledged that the research funds for indigenous forests are meagre.

Recommendation 3

To achieve the first two recommendations any research programme must be integrated and coordinated. A mechanism such as an annual conference which brings together those who are doing the research (ie universities, Ministry of Forestry, Forest Research Institute and Landcare) with those who require the research to be done should be sought. Short-term and long-term projects could be identified and programmes worked out. It is envisaged that the forest owners would be encouraged to embark on their own research programmes with the assistance of the research institutions.

"If sustainability is able to be achieved anywhere it will be in New Zealand's indigenous forests". Rt. Hon. Dennis Marshall, July 1994, Forestry School, Canterbury University.

7.0 Conclusion

The concept of sustainability is complex it being made up of a number of dimensions and 'sub-dimensions' as well as a variety of interpretations. It has been argued that the concept has been appropriated by various disciplines and constructed into a number of interpretations of what it 'is'. While this is possibly a strength of the concept, in that it allows many narratives to be expressed, often only some of these are being listened to. It has generally led to people talking past each other and allowed past 'unsustainable' practices to continue under the guise of a new rhetoric.

In 1987, Edward Barbier developed a model of sustainable development which attempted to overcome these problems (Figure 1, page 23). Rather than develop yet another definition which would have invariably focused on one or two dimensions his model was able to give more of an understanding toward the 'whole' than any previous definition had been able to do so. He argued that the concept of sustainability was both multi-dimensional and dynamic in nature. His model thus allowed for a multiplicity of interpretations of sustainability. Barbier acknowledged that the model which he had developed was limited and suggested that the model could be developed further.

In this thesis the offer was taken up and the model of sustainability was further developed in an attempt to create a resource management tool with analytical rigor for assisting in the analysis of issues and problems. The reconceptualised model was based on the original model along with its dimensions and premises, ie that sustainability is multi-dimensional and dynamic (see Figure 3, page 28).

It was argued that over the last one hundred years or so there has been three distinct waves of thought, each successive wave coming closer to what Barbier identified as the integrated area of sustainability shaded at centre of the model. These waves of thought created movements and in turn disciplines, or sub-disciplines. A number of these subdisciplines and their ideas could be logically located in the model.

It was also argued that many of the 'sustainable solutions' which are being promoted and applied today are for the most part found on the periphery of the model and therefore could be called weakly sustainable. According to Redclift [1994] these 'solutions' tend to deal with the symptom of the problem rather than the underlying cause. They also tend to take into cognizance fewer rationalities than the strongly sustainable 'solutions' near the centre of the model.

The theory of Postmodernism, particularly its critique of science, was introduced in order to help provide dynamism into the model and direction between the so-called weak sustainability and strong sustainability paradigms. It was argued that there are underlying reasons why it is proving to be difficult to move from the area around the periphery of the model, deemed to contain weakly sustainable 'solutions', towards the centre of the model, deemed to contain strongly sustainable 'solutions'. These underlying reasons can be partly explained through the way that science, as the 'supreme' creator of knowledge, has constructed reality.

Rather than being objective and value-free, as science claims, it is actually based on a set of beliefs and assumptions. These beliefs and assumptions form the basis of all scientific disciplines including forestry. While these beliefs and assumptions lay hidden it is argued it will be difficult to move from a weak sustainability paradigm to a strong sustainability paradigm[1]. In its present form science serves to stifle other rationales and realities along with possible strongly sustainable 'solutions'. Once these beliefs and assumptions are 'deconstructed' and exposed

[1] A strong sustainability paradigm would contain both 'weak' reductionist solutions and 'strong' holistic solutions.

science then becomes one narrative amongst many narratives, albeit an integral one.

Further, in order to realise sustainability the meaning of science must be expanded to include so-called 'wild knowledge' as well as scientific rationalities. Such wild knowledge is usually associated with traditional cultures, however, examples of such contextual, adaptive and integrated knowledge is beginning to emerge from the indigenous forests in New Zealand. This must not be allowed to be subjugated over. Its discourses on diversity in particular must be listened to.

As an analytical framework the reconceptualised model of sustainability proved to be a useful resource management tool. Rather than defining and analysing sustainability from one or two perspectives, which is the more usual technique, the model requires the analyst to look at the question of sustainability from six different standpoints. This helped bring into the analysis, or rather synthesis, a multiplicity of rationalities for realising sustainability. This was an attempt to increase the holism of the model reflecting the holistic nature of the concept. As well as providing a way to look at sustainability the model also provides direction on the various perspectives within each of the dimensions of sustainability. It is envisaged that in the future this model could be used for resource analysts to carry out 'sustainability audits' of various projects or for resource owners to carry out such audits of their own projects. From these audits then integrated programmes could be developed to improve sustainability within each of the sub-dimensions for improvement of the 'whole'.

The model was not used as an analytical framework in the analysis of indigenous forest policy, legislation and research in New Zealand. However, it did help to shed light on some myths about indigenous forests which were created during a phase of 'primacy of settlement'. It was argued that these myths were perpetuated through time and their continuance only serves to hinder sustainability within indigenous forests.

This is not to preclude the model's use as an analytical framework for forming indigenous forest policy, legislation and research initiatives, however. In fact, it is argued that it would be ideally suited to this function. This was not carried out in this thesis because it was felt that this should come about through an appropriate participatory process[2] rather than within the confines of a thesis.

There are a number of limitations to this model of sustainability. The first is that there are shortcomings in its ability to represent 'reality'. For example, in 'reality' virtually all the dimensions overlap each other. None of the dimensions can exist without the other, at least while there are humans on the Earth. This may be seen as a problem. However, the strength of the model lays in its usefulness. While it may not be a diagrammatically 'correct' or 'true' representation of the world, however correctness and truth are defined, it is able to include a greater number of sustainability rationales and provide direction which was lacking in previous definitions of sustainability.

Sometimes it proved difficult to place ideas strictly into different dimensions when using the model as a framework. While this problem was overcome it demonstrated how inter-connected the dimensions are and how a reductionist approach could easily exclude parts of the 'whole' making a comprehensive analysis untenable. Another limitation of the model is that there may be, and probably are, other sustainability rationales which have not been and possibly cannot be identified or placed in the model. However, this is balanced against the 'fact' that in the past often only one or two dimensions were taken into account whereas in the analysis of the case study within this thesis six dimensions were able to be taken into account.

The authors interpretation of the model and placement of certain ways of looking at the world within it may also be questioned. While this may be seen as a

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[2] Appropriate participatory process is defined here as a process which includes a mix of both 'bottom-up' or 'grass roots' participation and 'top down' approaches from government institutions and research agencies.

limitation it could also be seen as a strength. As sustainability is dynamic so is it interpretation. The author's interpretation does not claim to be **the** truth but it is a 'little narrative' which appears to be appropriate in this time and context. If the model is used by others it could be altered, expanded or rejected where appropriate[3]. As sustainability is a reflexive process, involving adaption and co-evolution across the dimensions, so should be any model which purports to represent it.

In the analysis of the case study using the reconceptualised model as a framework possibly the reader noticed that the economic and biophysical dimensions contained a 'more' comprehensive analysis than perhaps some of the other dimensions. This is partly a reflection of the author's background and bias. If a sociologist or an engineer made use of the model for analysis one may suspect that a bias may be seen respectively towards development or appropriate technology. However, in all cases the model compels the analyst to at least address the other dimensions of sustainability which they may not otherwise be inclined to do or even think about. The model would possibly be best used as a framework for co-ordinating interdisciplinary teamwork at either the project (micro) or industry (macro) levels in order to integrate and improve their 'sustainability' rationales.

In conclusion, de Vries stated that, "*planning for sustainable development assumes that a blueprint for Utopia can* ***and should*** *be made ... a recipe for how to travel towards the end of the road*" [de Vries 1989, p8 cited in Redclift and Sage, 1994, p24]. This thesis does not purport to be a blueprint nor a map, but it does provide direction for how to travel **towards** the end of the road... an end which will never be actually met as the road is constantly changing, but hopefully with a change in human attitudes to the environment and an appreciation and inclusion of a wider set of rationales we will not stray too far from the road to sustainability.

[3] Appropriate is defined here as something which has an ethical basis and is useful in a time and context (ie does not become a 'grand narrative').

"Those who argue that this interpretation is extreme and the suggested guidelines for sustainable development are utopian (or Draconian, depending on your point of view) have an obligation to refute the analysis. If the basic argument is sound, the real utopians - dreamers of the impossible - are those who still support the material growth ethic and maintenance of our economic status quo" [Rees, 1990].

8.0 Epilogue

Ali Memon and Wilson [1993] commented that "*Indigenous forests in New Zealand are a diminishing resource*". I have a vision which was the basis behind me doing this thesis. My vision is to see the forests come back down from the mountains where they have been banished and once again cloak the plains and become part of our lives. As such, my thesis is not an objective nor impersonal analysis; there is no pretence of neutrality. This was never the intention and I would argue that an objective analysis is impossible anyway for reasons that I have outlined in the thesis. My intentions were to provide a document which was based both on ethical beliefs and scientific 'facts' but more than this is useful.

I chose to study the area of indigenous forest management in New Zealand because of the admiration and respect I have for these forests. At the beginning of my journey into this thesis I had intended on writing about trees and their management but early on it became apparent that any in-depth resource management study had to involve people and their perceptions of forests. So the thesis became to be more about the views of people and the relationship they have with forests than about trees and forest management *per se*.

Throughout my journey I was faced with a number of hurdles and dilemmas. I could have approached this thesis by asking the usual types of questions using the usual types of method. I instead I decided to take the challenge and chose to ask

different types of questions using different types of methods. This was done in the hope that this would provide greater insight. The difficulty with this approach was two fold. Firstly, I think that I would have felt more comfortable doing it this way if my background was in the social sciences. Coming from a natural science background I was unfamiliar with many of the concepts and terms. Secondly, I was for the most part unsure to where such questioning would lead. If it led me to gain better understanding that would be fine. However, it could have also lead me nowhere. This is a risk I took. In the end I feel that I have gained a number of insights which otherwise I would not have gained.

This was brought home to me recently when a scientist friend and I stopped off on an island while out sailing. We went for a walk over the island and rested in a grove of kawakawa. As we sat there my childhood memories flooded back of me pushing through the wet kawakawa in the hills behind Waikanae with a heavy load of possum traps on my back. Images of elderly Maori women dressed in black, wailing at a tangi and waving sprays of kawakawa also came to mind. My friend said to me "I wonder what pest has caused the damage to the leaves" indicating to the holes which are invariably associated with kawakawa. To me there was no damage and no pests; it was just kawakawa. Without the holes it would not have been kawakawa to me. The holes are part of the plant and the plant part of my memories. Her comment reflected her position as an entomologist trained in the methods of Modern science. Which perception of kawakawa is more real. The significance of kawakawa to my memories, the spiritual significance of kawakawa to the women at the tangi or the observation of the scientist. Only one 'reality' can be proved to exist or not to exist using scientific method. Are the other realities not realities? Are they even seen to exist by science? As Lynn White Jr. proposed, in his classic environmental expose, that what people **do** about their environment depends on what they **think** about themselves in relation to things around them; in particular their natural environment. He said that the way people actually live in their natural environment is deeply conditioned by their beliefs about nature and destiny (White, 1967). I believe that these questions about what is reality have important ramifications both for resource management and sustainability as

sustainability is about values at least as much it is about science.

Another dilemma for me was which lens, or worldview, should I chose to look at the issue of sustainability. The Modernist scientific tradition has advantages in its method of creating knowledge and would readily offer me help. However, sustainability is about values, beliefs and a variety of worldviews as much as about scientific understanding of the world. Further, in the 35 years that I have been on this planet New Zealand has seen a reduction in its indigenous forests despite the best intentions of foresters and science. I, therefore, felt that to gain a deeper understanding of the problem I would have to choose an alternative path; one which would invariably bring me into conflict with the fore mentioned tradition, its beliefs and ways of knowing. This I do not apologise for. Small incremental changes and an unquestioning of underlying assumptions have not bought about an increase in the size of New Zealand's indigenous forest estate. I believe we have to make radical changes in our behaviour and our attitudes to indigenous forests in order to realise sustainability within them.

Another dilemma I faced was that rather than just studying and writing about sustainability I felt that I also had to practice it. As I argued in the thesis, sustainability is a state of becoming rather than a state of being; it is a process rather than an end state. I feel, therefore, that I had to be in the process of becoming sustainable myself; to be subjective about what I was studying and place myself into the research. As I do not own a forest in which to express this, I felt that I had to do so in my daily life. Consequently I had to begin to think about and **do** things that I feel were more sustainable. When making daily decisions I tried to weigh up the situation and take the option which I believed to be the most sustainable one. Sustainability is now one of the criteria on which I make decisions. It influences the things that I buy, whether to grow 'vegies' or not, to recycle or not or whether to drive my car to university or take the bus or bike. It influenced my decision to grow some native plants from seeds sourced in Kaituna Valley and replant the seedlings I grew in another area close by.

My vision for the future of indigenous forests in New Zealand is an increase in their area and the maintenance or improvement in their health. Forest health in this context is defined as a situation in which the forest in question is able to continue to function as an ecological entity within its natural limits whilst maintaining a positive increment. I believe this vision can be realised through the application of sustainability both as a concept and as an environmental ethic.

I may be accused of being a dreamer but I believe that a dreamer is better able to create a vision than can a pragmatist. I believe that this dream can be accomplished through the sustainable management of our indigenous forests. I see this happening only if people are able to celebrate their diversity and take advantage of the economic opportunities that this diversity provides.

I see the outlook for sustainability within indigenous forests in New Zealand as positive. There are signals of changes which are taking place which gives me this confidence. The likes of Peter Topping, Dr John Wardle and Iain MacDonald and their families who are trying to realise this vision and have been doing so prior to the introduction of any legislation give me this confidence.

Changes within the institutions are also beginning to take place. While the amount of research into sustainability and indigenous forests is modest, the recent introduction of courses at Forestry School in areas such as indigenous forest management give one cause for hope. Perhaps when courses in philosophy and ethics, human ecology and feminist thought are part of the curricula for forestry students we may see even greater changes there.

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